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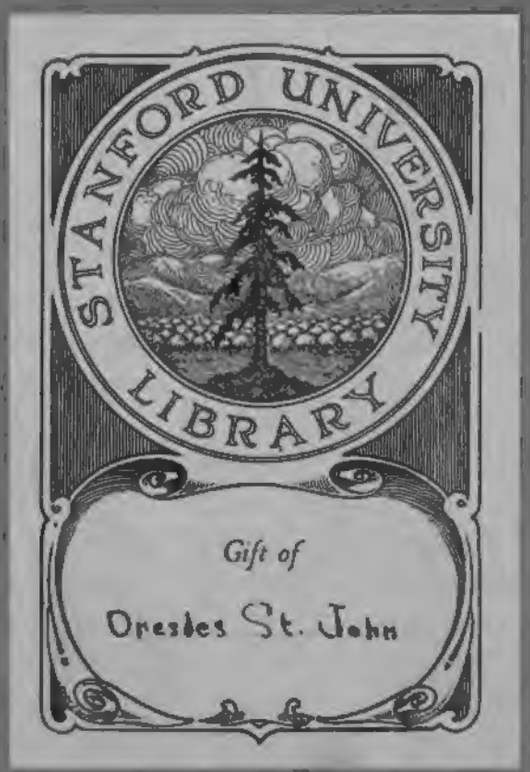
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ILLUSTRATED CATALOGUE

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY,

AT HARVARD COLLEGE.

No. VII.

REVISION OF THE ECHINI.

BY

ALEXANDER AGASSIZ.

PARTS I.-II.

WITH FORTY-NINE PLATES.

UNIVERSITY PRESS, CAMBRIDGE.
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NOTICE.

THE concluding Parts (III. and IV.), containing the description of the species not included in Part II., and a review of the anatomy and classification of the order, will be issued as soon as practicable.

ALEXANDER AGASSIZ.

PART I.

INTRODUCTION.

BIBLIOGRAPHY.

NOMENCLATURE.

CHRONOLOGICAL LIST.

SYNONYMY — SYNONYMIC INDEX.

GEOGRAPHICAL DISTRIBUTION, WITH PLATES *A, B, C, D, E, F, G.*

INTRODUCTION.

THE present Revision of the Echini has been in my hands for the greater part of six years; its publication has been delayed from the impossibility of examining a large number of the original specimens of the principal writers on the subject. Its earlier appearance would have been useless without such an examination. This was made during a recent visit to Europe, when the species of Echini (with very few exceptions) described during this century were examined, and carefully compared with specimens sent from the Cambridge Museum to Europe for that purpose.

Of many of the specimens we have, of course, only the tradition that they are the originals made use of by various authors; this is especially the case with the types of the older authors in the Jardin des Plantes and in the British Museum; but as no one has recently attempted to make direct comparisons of the numerous species described independently, it is not astonishing that when such a comparison is made the number of species distinguished should be found to be so small.

To Dr. John E. Gray and the late Dr. Baird of the British Museum I am indebted for giving me every possible facility to examine the collections of the British Museum, containing the types of Dr. Gray's Catalogue of Recent Echini, of his papers in the Proceedings of the Zoölogical Society of London, in the Annals and Magazine of Natural History, in the Annals of Philosophy; to Dr. P. L. Sclater for his kind assistance in hunting up the types formerly in the collection of the Zoölogical Society; and to Dr. Charles Stewart for his aid while working in the rooms of the British Museum.

The collection of Echini made by Professor Percival E. Wright at the Seychelles Islands was examined at Dublin. Dr. Carpenter and Mr. Jeffreys allowed me to examine, in company with their colleague, Professor Wyville Thomson, the Echinoderms, collected in the different cruises of the English Deep-Sea Dredging Expeditions, which had been brought together

at Belfast. To the Rev. A. M. Norman I am indebted for information respecting several British species. At Liverpool, in company with the curator of the Derby Museum, Thomas J. Moore, the excellent collection of Echinoderms brought together by his care was examined; it contains numerous interesting species from localities rarely represented in collections.

At Stockholm, in company with Professor Lovén, the booty of the Josephine Expedition was carefully examined, and I had also the opportunity of seeing authentic specimens of most of the species described by Scandinavian authors, most admirably preserved, as are all the Invertebrate Collections of the Stockholm Academy,—a model, indeed, to be followed in the system adopted for exhibition. To Professor Lilljeborg I am also indebted for information respecting some of the Echini of Linné, still preserved in the Museum of Upsala.

At Copenhagen Professor Steenstrup allowed me the freest access to the collections of the University; and in company with Dr. Lütken I had the opportunity of examining specimens of the species described by him in his Bidrag, and of improving my acquaintance with the species of the Norwegian coasts.

To Dr. G. O. Sars I am indebted for a complete series of the species of Echini inhabiting the coast of Norway, collected at the Lofoten Islands during his Dredging Expeditions.

Professor W. Peters and Dr. Martens, of Berlin, most kindly gave me access to the originals of the Echini described by the former from Mozambique, and by the latter from the eastern seas, principally from Japan.

At Hamburg, Mr. C. L. Salmin and Dr. Schmeltz, the curator of the Godeffroy Museum, gave me the freest access to the materials which interested me, while to Dr. Shilling, curator of the Hamburg Museum, I am indebted for similar favors.

Through Professor Grube, of Breslau, I have had access to the remarkable Echini he described in 1867, and which have thus far remained unique in the history of Echinoderms.

In Leipzig, a few interesting species from Australia were shown me by Professor Leuckhart. Professor Kölliker gave me the freest access possible to the collections in his charge, while Dr. Semper allowed me to make a very careful examination of his magnificent collection of Echino-

derms from the Philippine Islands, from which most valuable information respecting the geographical distribution of many species was obtained.

At Frankfort, I examined the collections made by Rüppell in the Red Sea.

At Stuttgart, Dr. Krauss allowed me the freest use of the collection of Echini made by him at Natal.

In the University Museum at Bonn I found the types of Philippi, as well as those of Professor Troschel himself, to whom I owe this opportunity of examining them.

To Professor Ehlers I owe the discovery of the original specimens of Klein, the most valuable historical collection of Echini in existence, which has served as the basis of all the names proposed by Leske; and as they are generally adopted, it has been of incalculable service in clearing up a multitude of doubtful points. Through his exertions the Senate of the University of Erlangen allowed the collection to pass to America for examination.

At Neufchatel, M. Louis Coulon placed at my disposal many authentic specimens which formed a part of the material of the Catalogue Raisonné. A few other species were found at Geneva through the kindness of the late Professor Pictet. M. de Loriol spent considerable time in examining with me his valuable collection of recent and fossil Echini, among which were some interesting species from Ceylon collected by Mr. A. Humbert.

The basis, however, for the accurate determination of most of the species of Echini was found in the collection of the Jardin des Plantes. There are preserved the originals of most of the species of Lamarck, and all the collections brought home by the great French Exploring Expeditions. This collection formed the chief part of the material of Blainville, and again of the Catalogue Raisonné, so that without a very critical examination of this collection no commencement could be made.

Professor Deshayes allowed me to examine the collection of the Jardin des Plantes as if it were my own, and all possible assistance was rendered me in identifying the types by Messrs. Rousseau and Potteau, whose long acquaintance with the collection made it possible to identify many things of which the tradition must soon be lost.

Professor Lartet gave me the opportunity of examining the few recent species described by D'Orbigny still preserved with the rest of his collections in the Paleontological Department of the Jardin des Plantes.

To Mr. Cotteau the Cambridge Museum is indebted for a fine series of the many new genera and species described by him in the Échinides de la Sarthe, in the Paléontologie française and other papers. In his private collection at Auxerre were also authentic specimens of many of the species described by Desor and Michelin; the recent species it contains have been in many cases labelled by both Michelin and Desor.

Another most important collection, containing much of the material of the Catalogue Raisonné, is the collection of Deshayes and that of Michelin, now in the École des Mines. Michelin described a large number of species, which are here carefully labelled in his own handwriting, making it possible to identify all the species described by him in the Revue et Magazin de Zoologie, thanks to the courtesy of Professor Bayle.

At Vienna, I saw the collections of the Novarra Expedition made by Frauenfeld.

The only collection of importance which I have not personally examined is that of Desmoulins, owing to the breaking out of the Prusso-French war. The greater part, however, of his species are in the collections of the Cambridge Museum, having once formed a part of the collection brought to this country by Professor Agassiz, with whom he was in correspondence during the working up of the Catalogue Raisonné.

To Mr. Bouvier I am indebted for a most interesting collection from Cape de Verde Islands. To Mr. Crosse for a number of species from New Caledonia, and to all the gentlemen named above for typical specimens carefully compared with the originals of all the species which could be spared. I have thus succeeded in bringing together in Cambridge, with the addition of the information obtained by comparisons with specimens sent from Cambridge for that purpose, an unrivalled historical collection, for which I cannot thank too cordially the many friends in Europe who have so generously assisted me in my labors.

The materials existing in the United States have in a similar way been carefully examined. The whole of the collection of Echini of the Smithsonian Institution has, thanks to the generosity of Professors Henry and Baird, been in my hands for a considerable period. It contains the materials of the several explorations of the east and west coast of the United States, made under the direction of the Smithsonian. To Dr. Stimpson I owe the opportunity of studying the Echini of the North Pacific Exploring Expedition, collected by himself. The Academy

of Natural Sciences of Philadelphia allowed me, through Professor Leidy, access to their collection containing many interesting species, especially from the South Pacific. Professor Verrill has invariably communicated to me with the greatest readiness the species he was describing from the Museum of Yale College. To Mr. Putnam I owe many valuable specimens from the collections of the Essex Institute, principally from Zanzibar and other portions of Africa.

The collection of the Museum of Comparative Zoölogy itself contains the types of the majority of the species of the Catalogue Raisonné; the immense collections of Echinoderms made by Mr. A. Garrett at various points in the Pacific Ocean, by Mr. C. Cook at Zanzibar, by Mr. Henry Edwards in New Zealand and Australia, by Mr. Thomas G. Cary at San Francisco; the collections of the eastern coast of the United States from Maine to Florida, made by Professor Agassiz; the collections of the Thayer Expedition in the West Indies and Brazil; a collection of Mediterranean species made by Professor Panceri; the collections of Mr. Pourtalès from the deep waters between Florida and Cuba; my own collections from Panama, the west coast of Mexico, California, and the Gulf of Georgia, besides innumerable exchanges made with other museums which will be noticed in their proper places.

The material accumulated in Cambridge represents, with but four or five exceptions, every species described during the last forty years. A good deal of unpublished matter collected by Professor Agassiz for the continuation of his Monographies d'Échinodermes has been incorporated in this Revision. The freest use has also been made of preparations made under his direction by the late Nathaniel Bowditch, and of a collection of sections of spines of Echini begun by Mr. Glen and continued by Mr. Bicknell with admirable success. Mr. Bicknell has also made for the Museum microscopic preparations of such pedicellariæ and spicules as have been found necessary.

For the careful execution of the lithographic plates I am indebted to Mr. P. Roetter; to Mr. A. Sonrel for the preparation of the negatives needed for the Woodburytype and Albertype processes which have been employed for some of the Plates of this Revision. I have also to thank Messrs. E. Bierstadt, of New York, and John Carbutt, of Philadelphia, for the trouble they have taken in making the necessary adaptations of their methods of printing to the needs of Natural History illustrations.

I must beg indulgence for the mistakes of omission and commission which have undoubtedly found their way into the first part containing the Synonymy. I shall be greatly obliged to be notified of any errors discovered hereafter by those who may make use of this Revision.

ALEXANDER AGASSIZ.

CAMBRIDGE, August, 1872.

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In addition to papers containing descriptions of Genera and Species, everything relating to the recent Echini, to which I have had access, has been brought together which had any bearing on the anatomy or classification of the order. Papers and memoirs on fossil Echini which were considered essential to a proper understanding of the affinities of the recent species have also been added. Papers containing merely descriptions of new species of fossil Echini have been omitted, but wherever generic divisions are discussed or proposed they have been quoted. The full titles have not been quoted (but they are abbreviated so as to be readily recognized), as the Catalogue of Scientific Papers by the Royal Society, and the usual Bibliographical works and Reports now regularly published, will furnish the desired information. Carus, in his Bibliotheca Zoologica, is very severe upon the Bibliographia Zoologiae of Agassiz, edited by Strickland. I do not wish to enter into a criticism of his views, but would remark that he has himself been quite as guilty of sins of omission, as far as the present order is concerned, as the author of the Bibliography he so sweepingly condemns.

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* Dr. Kersten has seen fit, in the Preface to Decken's Reise, to make an extremely violent and impudent attack on the Director of the Museum of Comp. Zoölogy for not having laid at his feet the collections of the Museum, made at Zanzibar. The Director of the Museum has invariably, whenever possible, and for the interest of the Museum, sent the materials at his disposal to well-known naturalists, not only in this country, but also abroad, as the following partial lists of collections intrusted to European scientific men will fully show: — Prof. Allman, Barrande, Prof. Geinitz, Dr. Kölliker, Prof. Keferstein, Prof. O. Schmidt, Dr. Ehlers, Prof. Selenka, Dr. Smitt, Dr. Gerstaecker. As Dr. Kersten had no claim whatever to have valuable collections intrusted to his care, his demand (it was not even a request) was treated as it deserved. — A. AGASSIZ.

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NOMENCLATURE.

So much has already been written on the subject of Zoölogical nomenclature that the only excuse I have for adding anything on the subject is to give the reasons which have prompted me to adopt a somewhat unusual course in treating this question, and to state explicitly on what grounds I have adopted views differing radically from those of so many naturalists.

We seem apparently all agreed in considering synonymy our *bête noire*, yet any attempt to introduce reform has invariably raised a general outcry, and matters have been left to run their course unchanged. The question naturally arises, if we can go on indefinitely as we are doing. Are we not bringing Zoölogy into disrepute, lessening its scientific character, in allowing a mere shuffling of names to pass as science and place itself as an immovable barrier to all better work? Most of us have at some time or other worked up some monograph in which the questions of nomenclature have absorbed more time — and with no satisfactory result — than the remaining scientific portions of the paper. Is it not possible to adopt some nomenclature which will make it clear to all what we mean without involving this great loss of time? In all matters of nomenclature there are two main points to be brought out conspicuously: in the first place, the original name of the species we are discussing; and in the second place, its present position in the Zoölogical System. The notation to be adopted for these two points would seem to be simple enough, and so it would be were we to speak of a species always by its original name; but when we attempt, by the notation commonly received, to give a succinct history not only of the species, but also of the name of the species, it is not remarkable we have failed to define clearly so much with such a defective nomenclature. Availability in practice must, after all, modify any principles, which may work very well as far as one class is concerned. If the principles are conducive to present stability and direct research again into its proper channel, the object is gained; for to obtain ultimate stability of nomenclature is as hope-

less a task as to fix the limits of a species; to accomplish that, we must ask science to come to a stand-still; but if we are willing to reduce nomenclature to its proper functions, we need not waste, as we do now, our time upon bibliography.

The attempt to trace the origin of the generic names now in use among Echinologists is far from giving satisfactory results. There are writers of three distinct periods who have increased the confusion already existing at their time.

The first is the period of Linnæus and Gmelin. They took no account whatever of what there was good among their predecessors, ignoring as far as Echinoderms were concerned much valuable work by Klein, Leske, Breynius, which compares very favorably with many papers on the same subject, even of the present day. They were followed by Lamarck, who ignored as completely as his illustrious predecessor the work previous to Linnæus.

In the second period we have the attempts of Gray, Blainville, Agassiz, Desmoulins, Desor, to take into account, as far as possible, what had been omitted by their predecessors, and to give due credit to Breynius, Klein, Leske, Van Phelsum, for whatever there was original in their memoirs. Breynius, as early as 1732, had, to some extent, adopted a binomial nomenclature, accurately (for his period) discriminated genera and species, many of which are readily recognized, but which had escaped the notice they deserved till a comparatively recent period.

In the third period, subsequent to the publication of the Rules of the British Association for the Revision of Nomenclature, we have the writers from 1845 up to the present time, Agassiz, Desor, D'Orbigny, Cotteau, Wright, Forbes, A. Agassiz, Lütken, Verrill, and others, who have attempted more or less successfully to apply these rules, and have in many cases only increased the existing confusion. By going back to the earliest writers, and restoring as far as practicable the condition of things then existing, we can see how far we must modify the nomenclature generally adopted by the Echinologists of the present day, and yet give due credit to the pioneers of this department of Zoölogy. In the discussion of this question I shall not be guided by any cast-iron rules of priority, nor do I acknowledge the right of the British Association, or of any other association of scientific men, to dictate how and in what way certain fixed axioms (fixed only by them, and subsequently remodelled) shall be my guide in the matter of nomenclature. The authority of great scientific names has just as little to do in this question, and I must

frankly state that I do not intend to impose the names I propose upon any one. I shall simply attempt to reconcile the past with the present, and show, as far as can be ascertained, what species the old authors probably intended to describe. As far as the question of priority of the specific name goes, the only guide I shall take is an original or authentic specimen, and when a species which has once received a definite name can be recognized, the oldest name shall be preserved to the exclusion of all others, if the change is based upon authentic specimens, and not simply upon a figure, a guess, which may or may not be a true one. It is, however, not in the matter of the specific name that uncertainties and doubts and differences of opinion are likely to arise, but in the binomial combinations, particularly with reference to the generic name and the limitations we choose to assign to it.

Scarcely an original investigator recognizes within the same limits all the genera adopted or proposed by his predecessors. New discoveries must constantly modify our points of view, and in accordance with this state of things I look upon binomial combinations as expressing (as a matter of record) the opinion of any investigator of the affinities and of the history of the species mentioned by him in his monograph. I also here wish distinctly to protest against the habit which has become so prevalent among systematic Zoölogists, to make the rules of the British Association retrospective. We have no right to go back previous to 1840, and say to Lamarck, "When you limited the genus **Spatangus**, you should have included in it only such species as **Spatangus pectoralis**; or go back, in 1825, to Gray, and because he names as belonging to **Echinocardium**, **E. lacunosus**, to change all the species which have, since Lamarck, been separated from **Spatangus** as *Plagionotus*, back to **Spatangus**, change next all species of **Spatangus**, making a new name for it and for *Plagionotus*, change **Schizaster** into **Echinocardium**, suppress **Echinocardium**, devise a new name hence for *Moera*,* for **Amphidetus**, — in fact, I will undertake, by following out strictly the rules of priority, and other rules as established by the British Association, for the sake of obtaining greater accuracy, and to simplify nomenclature, to change the generic and specific names of seven eighths of the received names of recent Echini, — a process which would be highly conducive to accuracy, and which I respectfully decline to go through, leaving this pleasant task to others who may feel disposed to undertake it. To save them trouble they will find all the necessary material in the accompanying pages of Synonymy.

* Preoccupied, LEACH, 1813, and HÜBNER, 1816.

Can we carry out successfully any laws of nomenclature? Must we not always be guided, when treating special cases, by the practice current at any given time? Have we the right to introduce distinctions unknown at the time of Linnæus, of Klein, of Leske, for the sake of harmonizing the past with the existing condition of our knowledge? When Leske says his *Cidaris esculenta* is the *Echinus esculentus* of LIN., we can only say that, from what we know now, after examination of authentic specimens, they are different species, even belonging to different genera; such a comparison forms a substantial basis for the correctness of our recent specific names. When we come to apply the same rule to genera, the case is not so simple. Is it advisable to restore **Echinanthus** KLEIN, as Gray has done, to the exclusion of **Clypeaster** of LAMK., when the exact limits of the genus as understood by Breynius and by Lamarck show that although they included many identical species, yet they were by no means equivalent? We cannot afford to lose from the history of the order the early names, but we had better lose them if we are to introduce them at the cost of making endless confusion by giving them definite meanings their originators did not intend them to have. We can, without injustice to subsequent workers, frequently keep both names; but I claim that where a name is not used in the same sense in which the originator intended it, it should not be preserved and substituted to exclude subsequent names representing distinctions and differences of which the original writer could not have been aware.

Echinoconus BREYN., **Echinanthus**, **Echinospatagus**, **Echinobrissus**, need not be used to the total exclusion of Lamarck's names or of more than one of the genera into which **Echinoconus**, etc. has been subdivided subsequently; yet if afterwards any writer limits **Echinoconus**, etc., such limitation can always be understood or stated, and the old name retained for a section at least of the many genera each is composed of. I claim that writers who mentioned as type of a genus certain species did not attach to it the significance we now do; they used it as an *illustration* of what they meant by taking a well-known thing, and the very fact that they frequently made the type of their former genus the type of another, leaving to the first only other species either originally included or subsequently added, sufficiently shows what was the current opinion of the nature of a genus at that particular period. The fact is, that our species stand very much in the relation of a variable of which we are constantly (or were up to a comparatively recent date) attempting to state the value by means of constants.

Lamarck, in 1801, established **Nucleolites** and **Cassidulus**. In 1816 he transposed the species included in these genera, and we find in one case but one, in the other not one, of the original species left in the genus; this we can interpret in two ways: either Lamarck learned something between 1801 and 1816, extended, with the material at his command, the definition of the genera, and found that in 1801 he had included in **Cassidulus** species which really should have been separated from it; or else we must say, Lamarck's interpretation of the genus **Cassidulus** in 1816 was incorrect, the only correct definition is that of 1801. I prefer to take Lamarck's view to my own or that of any other naturalist who, fifty years or more afterwards, comes upon the stage and tells us what Lamarck meant or should have meant. Here it is that our confusion begins. It is by our attempts to interpret with our present knowledge a condition of things which we can with very best intentions but faintly reconstruct, that we are frequently doing gross injustice to previous workers. I will take another example, that of **Echinocardium** GRAY; he established this genus in 1825, placed in it what is now known as **Moera atropos** and **Echinocardium cordatum**. Because he afterwards (1835) restricted the genus **Echinocardium** to the second species (**E. cordatus**), and Agassiz subsequently placed in **Schizaster** this same (**S. atropos**), together with **S. canaliferus**, must we for that reason go back to the original meaning of Gray, restore **Echinocardium** for **Moera**, cancel all the species of **Echinocardium** by giving them a new generic name, — as Agassiz's **Amphidetus** cannot be retained, being synonyme of **Echinocardium**, as modified by Gray, not of the original **Echinocardium**, — next make a new name for **Schizaster**, for that is synonyme of the typical **Echinocardium**, and therefore must be dropped? This is perhaps an extreme case, but a similar mode of procedure has been adopted in other somewhat less complicated cases, the proposed recent changes being based upon old rectifications or emendations of the authors themselves which late writers have not allowed. I frankly acknowledge I do not see the strength of the argument which presumes to correct Lamarck fifty years after he wrote, and correct him, not because he was wrong, but because he ought not to have done something which the practice of certain Zoölogists of the present day disapproves. It may be highly creditable to a writer's acumen and critical knowledge of the existing condition of nomenclature to set up this man of straw and bravely knock him down, but it is not Zoölogy, and the sooner this style of writing, based entirely upon books, and not upon specimens, is done away with the better.

Our genera are constantly modified, and all we can do to define them is to state the limits within which we understand a genus; hence the difficulty of applying the rules of priority to generic names where the limits are so uncertain. The daily increasing list of specific and generic synonymes but too plainly tells the tale of our ignorance. Are we to attempt to define with mathematical accuracy what we mean by a species because we find it convenient to use a binomial nomenclature to express zoölogical units? As well attempt to solve an equation of an infinite number of unknown quantities by means of an equation of the second degree. In our nomenclature the best we can do at the present time is, by the examination of original specimens, to ascertain what are the limits at any time of what we mean by a certain binomial combination, and to express these limits by our synonymes. The fact is, that we can no longer define species as has been customary, and, with all descriptions, their value to other observers depends generally upon the amount of material at the command of the describer and of the reader. How can we enable others to ascertain what we mean? Scanty materials from few localities seem to limit a species within narrow limits, and no difficulties appear. But take an example of one of the most widely distributed species, — **Hippon. variegata**, found in Japan, the Sandwich Islands, Indian Ocean, east coast of Africa, the Red Sea, — and the diagnosis of the species will be very different if based upon material limited to any one locality, or perhaps upon African, or Japanese, or Sandwich Islands specimens only, and we find them appear as **Hipponoë subcoerulea** or **pentagona**, or **Hipponoë violacea** and **nigricans**.

A large number of systematic Zoölogists claim the necessity of recognizing geographical varieties by means of binomial names or of some kind of notation. What greater claim have they to be recognized than other categories, which are all members of the same species? The part these geographical species play in the limitation of Marine Faunæ is important, and the limits of our geographical subdivisions are closely linked with our interpretation of species; we cannot lose sight of the question of geographical variation any more than we can lose sight of the question of growth of an individual. But because geographical differences have received certain specific names before their connection was traced through intermediate gradation from many localities, must we for that reason retain this historical fact, any more than we are justified in retaining as a specific name the name of an animal which has afterwards been shown to be the young stage of one

previously described, or any more than we are justified in retaining the name of Pluteus paradoxus for the young, Ophiura for the adult, the name of Coryne for the Hydroid, and of Sarsia for the Medusa, or of Brachiolaria for the embyro Star-fish, and Asteracanthion for the adult. The synonomy and history of the species must show us all this, and any student of Invertebrates will readily call up countless instances where, if the principle of geographical names is once introduced, we might have half a dozen names which have a stronger claim for recognition to denote the different conditions, the various stages of growth of Echinoderms, Polyps, Acalephae, Crustacea, Annelids, Insects, Mollusca, and even Fishes where the genetic connection is not readily traced; yet no one has ever thought it feasible, or even advisable, to retain these connecting links, but, on the contrary, all writers have attempted, as far as in their power, to show why they reduce the number of appellations. We may call the various stages of growth by different names, as the Pupa Chrysalis or Imago, the Zoëa, the Pluteus, the Nereis, Heteronereis stage, the Amphioxus stage, — but we stop there; they are simply convenient terms to denote our finite knowledge; and in no way do we lessen their value by saying that we have no accurate definition of species, or by saying that species belong to the same categories as genera, differing only in degree; and so in admitting all the most zealous evolutionist could require, it does not lessen the fact of the finite condition of the differences we now notice, and which we call species or genera or families or orders, as we class them in various categories. For their transition, if such a transition does exist, can only take place through an infinite series, which still leaves the problem capable of a definite solution within fixed limits at any special time; and this is all that is needed for our purpose.

We know nature only through individuals, and whatever conclusions we draw are based upon the examination of a number of individuals showing a certain range of variation within definite limits, and these limits we call in some cases specific, in others generic, in others ordinal; and as long as we confine ourselves to the interpretation of nature, susceptible from such finite data, we need not trouble ourselves as to the metaphysical existence of species, genera, etc., or because we have no suitable definition of species applying to all classes of the animal kingdom, which, in the present state of biological science, it is absurd to expect. We are agreed for the present to call certain categories specific, others generic, others ordinal, and it matters only to us that we should distinctly state the

limits we assign to these categories in some way readily understood; and this the individuals or groups of individuals themselves belonging to the different categories will supply. Taking a small group like the Echini, in which the number of species is not large, we can readily follow in all the species the value of the characters which have been called ordinal, generic, or specific, and cannot fail to see how inadequate our diagnostic descriptions become as soon as we attempt to incorporate with them even the scanty information of the present day of the life history of any one species.

The genera recognized are usually based upon some structural features derived from the pedicellariæ, the poriferous zone, the character of the tubercles or their arrangement, the abactinal or actinal system, and general facies. Their value, when tested by our present knowledge of the changes they undergo, seems limited almost to convenient headings or keys for the more ready identification of species. Genera, as we recognize them among Echini, are certainly not founded upon features of general and permanent value, but, on the contrary, upon features applying only to a few species, and of very limited application. During the growth of the Sea-urchins of different groups, certain parts (different for the various divisions) change rapidly, others do not, and it is to these permanent characters, limited in their application, that we must resort as guides for our generic tests.

The structure of the pedicellariæ is very variable; in the same species they may be present in abundance, or totally wanting in specimens living under the same conditions. Yet, as characteristic of some groups, they furnish, as far as we know, excellent points of distinction. In some genera the number of the rows of vertical tubercles is constantly increasing; in others, the number of the tubercles alone increases. The perforation and crenulation of the tubercles, as far as we can judge from recent species, furnish excellent characters for a class of subdivisions; but what shall we call them? The poriferous zones give us good features to distinguish such groups in the adults as **Toxopneustes**, **Toxocidaris**, **Loxechinus**, **Sphaerechinus**, yet these same characters would not help us to place the young of the above in their proper genera; though, knowing the limits of the changes to which the poriferous zones are subject, they are an invaluable auxiliary in classification, in spite of their uniformity among all the Cidaridae.

The general facies which might, with accuracy, tell us that we deal with a young **Echinometra**, would certainly mislead us when we have before us the young of many a Spatangoid or Clypeastroid. The notches of the actinal

system, considered of such primary importance, are constantly likely to mislead us, by placing young and old in different genera. The changes in the abactinal system are as varied, yet, when we have once ascertained what is the range of variation for a group, the characters it affords are of the utmost value. In the irregular Echini, where the changes during growth are very marked, we find genera and species based upon characters the value of which is not the least understood. The shape, the position of the anus, the structure of the ambulacra, have always been considered essential; yet embryology teaches us that nothing varies more during growth than the outline, that the anus may be placed almost anywhere during the growth of the individual, and that the ambulacra may at one time be identical with those of the regular Echini, and pass through all intermediate changes to the petaloid state. We find, among Spatangoids, in the position of the apex, that of the mouth, and in the presence of the fascioles, features of primary importance; with Clypeastroids the structure of the interior proves thus far our safest guide; while among the Echinolamps we come upon a group beset with difficulties, where everything seems variable, and the changes passed through from young to adult would warrant placing the different stages of growth in each of the principal subdivisions established among Echini.

All our characters are variable; the greater our range of comparison, the less our standards become fixed or stable. How can we denote all this? Are we prepared to use a notation which will express these changes and be intelligible? Can we do more than give a rough sketch of such a condition of things? Our notation must be the growth of our knowledge, and its meaning and application must be simple; in spite of the definite existence of what we call species, genera, etc., when we apply these terms to limited regions and series of the present day, yet we find them totally inadequate to express our wider interpretation when our standards of comparison are infinite in time or space.

It is found impossible in practice to determine when a species is sufficiently described or not; hence no attempt can be made to discriminate in favor of this or that name on account of the character of the description. What was ample to separate the few species of Clypeaster known at the time of Lamarck becomes useless when describing species of the genus in 1870. From insufficiently described species (or so considered) we pass imperceptibly to mere catalogue names, known only from specimens deposited in public museums, or by the distribution of casts, or of types; finding

all possible gradations from these mere catalogue names to short diagnoses, short descriptions, or often a longer one, but not a whit more useful. What is an ample description to a thorough student or a specialist will fail most certainly to become adequate to the tyro or the master even of a different department. Where shall we draw the limit? Shall we take it for granted that our readers have the same material we have at their disposal, which we know not to be the case, or shall we presume that the student who is to consult the work has absolutely nothing except what any given locality on the coast is likely to furnish him? What appears a most simple question to be decided by a snap-judgment from small collections assumes a totally different aspect when the materials have been drawn from all possible quarters of the world; and in a monograph like the present one, to attach the same importance and to give an equal amount of space to each species would be impossible, while a full description of the most characteristic species of each genus (accompanied by figures) seemed the most appropriate method of dealing with the subject, the descriptions of other allied species becoming more or less comparative.

At first sight the question of giving to each species its true name (that is, the name it first received) seems a perfectly plain one, the choosing of the older being only a question of our ability to trace this; so it would be were we dealing with zoölogical equivalents. But what we now call our units (our species) are not the units of the time of Linnæus, or of the beginning of this century, any more than our present units are likely to be those of the last part of this century. Thus, at the very threshold of the question, we introduce an arbitrary element in our appreciation (from our present stand-point) of the condition of things at a different period. The names of these collective species, as they have been called, certainly ought not to disappear from the history of our science, if we can retain them by making such a limitation of these old units as we find it possible to make with our present units. Hence, when such a limitation has once been made for good and sufficient reasons by a previous writer, no one ought, except for better reasons, to attempt to make a revision of the limitation of these old names, unless the material at his command, such as an examination of the originals of the old author or carefully preserved tradition, evidently warrants him in upsetting generally received combinations. In the interpretation of such authors as Rumph, Breynius, Leske, Linné, when access to their collections is no longer possible (as their collections are irretrievably lost), we

can only be guided by collections made from the same localities, and adopt what seems most probable as correct, retaining, whenever possible, the names of the old authors, either for the species, as we now understand it, or for some part of the old collective name limited in a way which appears to have the greatest probability in its favor.

The strictest adherence to the rule of priority* must be our only safety as far as the specific name is concerned; for once admit only a moderate application of this rule, subject to the regulations of any scientific body or person, and we introduce endless confusion. Each case is to be judged by itself on its own merits. An old name, and the oldest name, once re-established, there is an end to all disputes; but as long as we except this for one cause, and that for another, we open the door for endless discussions between those who wish the exception to be made in one way rather than in the opposite, while perhaps they would both agree on the older name. In adopting an old name, the question of its appropriateness frequently seems a valid reason for preferring a more recent name, and one apparently more suitable. The old name was given to the young, or it was an abnormal condition, while the recent name applies to the usual form; yet why should

* It is, indeed, puzzling to ascertain with justice when an antique name should be substituted for a more recent one; by recent I mean any name posterior to Linnæus. There are, of course, as a general rule, all the arguments in favor of the adoption of the time of Linnæus, of some special edition of the Systema Naturæ, as the starting point for the adoption of strictly binomial names. Unfortunately, in the case of Echinoderms we can hardly say that Linnæus did even justice to the works of his predecessors. To unite as Asterias and Echinus all the subdivisions proposed by Link, by Breynius, was certainly a step backward at that time. Link, Klein, and Breynius specially showed a philosophical treatment of their subject far in advance of their age, and it was not till after the first quarter of this century that their labors began to be properly appreciated. This long neglect is certainly no excuse for not adopting what there is good in their works; and because Linnæus refused it recognition, we should not, if we can, fail to give them, the pioneers in the study of Echinoderms, due credit for what belongs to them. This difficulty of establishing the first starting-point for the adoption of the binomial system is not limited to Echinoderms alone. It occurs in other classes of the animal kingdom. It seems to me that whenever we can, with the aid of authentic specimens, restore the names proposed by these earlier writers, where, as is frequently the case, they propose excellent generic divisions, we should not hesitate to adopt them, no matter how great a disturbance it may bring into recent nomenclature. But I wish to be distinctly understood to admit that this is only practicable from an examination of authentic specimens, and that I have no wish to perpetuate names based upon descriptions or figures of old authors, or upon any lucky guess proposed concerning them. The above remarks apply not only to generic names, but also to specific. We frequently find in old authors, either accidentally or not, binomial names; these have been restored when an examination of authentic specimens made it possible. Of course, when no such *nomen triviale* of Linné (our specific name) was to be found, no attempt has been made to re-establish from the *nomen specificum* (the diagnoses of our days) a specific name, by selecting a suitable combination.

that be a reason for its adoption? What is normal here is not normal somewhere else; the young are frequently found in one place, while the old haunt totally different districts; in one place the old name would be perfectly proper; the other would be, for equally good reasons, adopted in another locality. The same objection may be made to geographical names when they are the oldest, and yet are found to apply to species of most extraordinary geographical distribution. It seems, at first glance, very unfortunate that the specific names of **Drōbachiensis** and of **sardica** * should have to be retained for species having such an extensive range,—in one case, from the Sandwich Islands, Japan, Indian Ocean, to the Red Sea; and in the other, on the two sides of North America, throughout the Northern Atlantic to Norway and Siberia and the coast of Kamtchatka. There certainly is nothing in a name if we judge it by its appropriateness, especially in the case of **H. sardica**, which is not found in Sardinia at all; yet what do we gain by substituting any of the synonymes, such as **neglectus** or **saxatilis** for **Drōbachiensis**, as has been frequently proposed? The time of geographical names is as much a part of the history of our science as any other, and if it has passed out of date, let us recognize it in the future by avoiding such names, but do not let us attempt to obliterate the past of our history by too much wisdom in our present time. Some writers have gone so far as to recognize the validity of geographical names for the sake of showing how far a species was cosmopolitan and the variations to which it was subject, retaining these names even after all the possible gradations existing between the two extremes had been clearly traced. If we allow this principle, where shall we stop?

The propriety, or rather the feasibility, of retaining the same generic name in different departments of Natural History has frequently been discussed. Botanists all agreeing to retain a generic name, even when employed in Zoölogy, we need only return the compliment and examine the possibility of retaining the same generic name in different branches of Zoölogy. It is claimed, on the one hand, with great plausibility, that, owing to the constant and more definite specialization of the different branches of Zoölogy, there can be no clashing of any consequence. Some Entomologists even go so far as to retain the same generic name for the various sections of entomology when it may be, apparently, employed safely. They see no objection to a Lepidopterologist, Coleopterologist, an Hymenopterologist, or a Dipterologist duplicating generic names. We strike here

* *Hipponoë variegata* A. AGASS. from authentic spec. of KLEIN.

upon an arbitrary distinction, — what constitutes an independent department now is not likely to remain one always; specialists may hereafter play a very unimportant part in the general progress of Natural History, and it seems as if we were knowingly introducing a most fertile element of discord into the discussion of the stability of generic names, — a question already sufficiently complicated. Are we to follow this same rule for Echinoderms and the other Radiates, where the number of species of each order is comparatively small? Can we repeat a generic name in Annelids, in Crustacea, and in Insects, because they belong to different classes? The intimate connection existing between Echinoderms and some Annelids seems likely to make a department of these two classes; and those who study Annelids or Crustacea are certainly of necessity compelled to have something to do with other Articulates. In fact, the Marine Invertebrata, Radiates, Mollusks, Articulates, will always remain a special field of study; and their connection with other classes of the same branches is so intimate that we cannot, consistently, draw a line for the retention of generic names, which would be limited by special departments of study.

When writing the Nomenclator Zoölogicus, Professor Agassiz proposed a large number of alterations in the spelling of the generic names in accordance with their correct etymology. It certainly would be a most desirable end to have our generic names etymologically and orthographically correct, but we are prevented from making the improvement, however desirable, from our inability to deal with names which have no etymology, and which we must either throw out or accept as they stand; if we accept them, we cannot refuse the same privilege to names partially or nearly correct; so that, when quoting an author, it is always best to quote him verbatim and retain his spelling. The only correction allowable seems to be that of the gender of the specific name attached, which should be corrected in our own books, but quoted in the synonymy as it stands. For this reason the same genus in the accompanying Chronological List, when spelled differently, is always supposed to be a new genus; of course in the synonymic list this is not the case, unless it is clearly a typographical error, in which case the fact is mentioned in brackets. If it were advisable, therefore, to retain **Cidaris** and **Cidarites**, I claim that they are *not* identical, the termination being amply sufficient to distinguish them; and we ought not to reject names differing as little as **Moulinia, Moulinsia, Moulinsium, Cassidula, Cassidulus,** simply because they are likely to be mistaken for one another; in our pres-

ent condition, with an infinite number of genera, a difference, no matter how slight, should be sufficient reason for retaining the name instead of coining a new one, which is just as likely to fall into the same category, and resemble another name in a different department to as great an extent. It will compel a little more accuracy in the very class of writers who are so punctilious and so anxious that nothing should be named twice, but who are constantly, in spite of this, making two equal three.

The completeness or insufficiency of the diagnosis of a genus is a worthless reason for rejecting a generic name; we find all possible gradations between a mere catalogue generic name and an admirably defined section. The impracticability of defining what a genus is,—for what two naturalists, working in the same department, admit the same limits?—shows the impossibility of applying to genera, as strictly as to species, the rules of priority. In old generic divisions which the advance of science has subdivided, it is of course advisable to retain the old names for some one section; but for which section? Here the most opposite views are current, one party claiming that you can limit the old name to any group of species of the original genus, the other that you must apply to these old generic names the same rules which have been proposed by the British Association, very likely long after the genus was established. The first have, at any rate, in their favor, the practice of the authors themselves, whom we find afterwards in their later works limiting their genera to any group of species originally contained in it. Old names are frequently thrown out on the occasion of such subdivisions, for not being grammatical, or for not being spelled correctly. Should we throw out **Brissus**, as universally spelled by Latin authors, because they should have spelled it **Bryssus**, then we must throw out a more modern genus **Leiocidaris** because it should be written **Liocidaris**, or **Echinopatagus** because we should say **Echinospatangus**, or **Nina** and **Metalia** for which our lexicons furnish us no clew. Let us remember that probably the greater part of our Zoölogical genera is made up with the assistance of a Greek Dictionary, and its correspondent parts joined to the best of our knowledge and belief; we can scarcely expect to obtain in this way classical names which the old Greeks would be willing to father. When, therefore, we take so much pains in presenting to our readers the derivation of the generic names, we should rather call it the composition. The meaning of words with the ancients has changed with the course of time, exactly as we find it in our own language;

but no one has for that reason compelled us to go back to the original meaning of the word, and, furthermore, no one expects it. Our only choice seems to be to quote an author as we find him, and give him all the benefit of his spelling, both for the generic and specific name as well as the gender of the latter. If we find, as is so frequent, **Diadema, Echinodiscus** .... with feminine species, **Diadema longispina**, etc., or **Salmacis*** **sulcatus, Echinodiscus aurita**, etc., we may correct the gender, but our office must end there.

It seems to be equally available to consider a proper name (Peron) as Latinicized into *ius* (Peronius), making the specific name Peronii, or to *us* when the case requires it; or else to consider the name as indeclinable, and add *i* to it for the specific name. Changes made, as is frequently done from one mode of viewing the subject rather than the other, seem inappropriate for reasons made sufficiently apparent previously.

To incorporate new material into recognized genera simply from descriptions, or even with the help of figures, is almost always an impossibility. The time has come when such work, at least in monographs, should be discountenanced, and no recognition paid to the numerous nominal changes, a mere shuffling of cards, so frequent in our Zoölogical literature. Let them receive the distinction they deserve as more or less successful guesses, and let due recognition be given to work based upon an examination of the originals or of authentic specimens. If the practice of showing by (*) or (!) what we know from personal examination were more uniformly adopted, much time would be saved in discussing subjects about which neither party has any accurate data. This plan has been followed throughout this monograph, and the (!) — *Echinus* **tuberculatus**! Lam. — means that I have seen the specimens themselves, or what are considered as such. When there is reason to doubt the authenticity of the specimen, the question-mark denotes it (!?) — *Cidaris* **annellata**!? Gray. The same notation is also used after the locality, — Sandwich Islands!

It was indeed "a true Pandora's box let loose upon science" when the practice of adding the authority after a name was adopted. Not that we can expect even specialists to remember who are the authorities for any particular combination, but this notation, to be worth anything, must mean something, and particularly refer us to some place where information on the subject can be obtained. When I write *Echinus* **ovum** Lam., I mean that in some work of Lamarck's he has mentioned a species (he may have de-

* A *Nymph*.

scribed it first there or not) by that name and refer to him for further information. If I write *Amblypneustes ovum* AGASS., I intend to say that Agassiz has somewhere mentioned a species by that name, and reference to the proper work will show if he means a new species or an old species. If I write *Amblypneustes ovum* LAM. *sp.*, I may or may not remember where the genus *Amblypneustes* was first published, — and in the multiplicity of genera at the present day to remember where a genus was first proposed is as impossible as to remember always where a species was first described, — the reference simply tells that after Lamarck's time somebody removed *ovum* to the genus *Amblypneustes*, but we get no other information to be made available without further search. The practice of regarding the authority given after a quotation simply as a *matter of reference*, and not as conferring any special honor or distinction on the writer quoted, would go far, I am persuaded, to do away with such constant changes, made with the only idea, I presume, of gratifying somebody's vanity, for the change of name teaches us nothing.

The practice of the old writers before the time of Linnæus was to cite authors, and, not being burdened with the question of authority, they were quoted for the information to be found there. The mode in which our synonymy is made up will, if analyzed, show us that this is the clearest way, perhaps, out of the various difficulties. We do not, in making our synonymes, write simply *Amblypneustes ovum* LAM. *sp.*, and omit everything else; we write

Echinus **ovum** LAM., 1816, A. s. V.
Amblypneustes ovum AG., 1841, Anat. g. Ech.

we refer to the place where information can be obtained, and when speaking of a species we have therefore two ways open, — either to adopt the method of always quoting it as first named, which is its true name, *Echinus* **ovum** LAM.; or else to use a reference, — the last reference is not always the necessary one, but that reference which we think truly expresses our ideas of its relationship. For this reason I would say *Amblypneustes ovum* AGASS. If anybody either previously or afterwards has transferred the species to a genus which does not agree with my views of its affinities, I do not quote it when speaking of it, while another author may do that in accordance with his views. Whichever name we adopt, the quotation of the appropriate place where further information can be found is given, which is not supplied by writing *Amblypneustes ovum* LAM. *sp.* The

synonymy will always give us the proper place of reference of the special combination adopted, while placing the first name under this, in place of all quotations, will show exactly what we mean. We have therefore adopted the principle of separating from the text all questions of bibliography and of history, which seem to find their natural place together, but which certainly are not to be considered Natural History, much as they may serve to clear our ideas and prevent confusion. By writing, therefore,

Amblypneustes ovum
Echinus **ovum** LAM., 1816, A. s. V.
Amblypneustes ovum AGASS., 1841, Int. Anat. g. Ech.,

I refer the reader at once to the place where the species was first described, and to the place in the synonymy where he will find the necessary historical information relating to the adoption of the name **Amblypneustes ovum**. If I have occasion to speak of this species, I shall most certainly speak of it as *Amblypneustes ovum* AGASS., as a mere matter of registration of Agassiz's opinion, which would be accompanied by no special glory to Agassiz, but be stating my agreement with his views of the affinities of *Echinus* **ovum** LAM.

All attempts to discriminate between the baptiser and the describer have proved futile. The gradations between what we can call a good description or a bad one, and a mere name recognizable from its connection, make it useless to draw any invidious distinctions in favor of the describer.

In works written by two authors, they are both quoted as the authority, unless in the body of the work itself a particular author is specified for certain species or genera. It is but justice to recognize catalogue names, or other information, sent to authors writing on a particular subject and published by them as manuscript names; it is furnishing finished material which would naturally fall under the head of joint authorship as soon as published, and due credit should be given to the author of this work, and not to the author of the volume alone. Free scientific relations must cease if the imparting information, freely given when asked, is, on account of its irregular mode of dependent publication, to be ascribed to the recipient of such information.

When names are changed in the transfer of a species from one genus to another, to avoid having two species of the same name in one genus, great care must be taken afterwards, if either of these species undergo a further change, to restore the original names, when confusion is no longer possible. The original name is frequently lost sight of in these generic transfers, and great care must be taken never to obliterate it.

In the case above mentioned, by adopting for the name to be changed one of its available synonymes, any transfer of the species afterwards which would make a return to the original name possible becomes a matter of course. In fact, we should always as much as possible transfer ourselves back to a special epoch and reconstruct the existing conditions, not only of the nomenclature, but also of the special department we are investigating. Great injustice is too frequently done to memoirs admirable for their time by judging them harshly in the light of recent information, frequently gained by the aid of the very memoirs so ungenerously treated, which have helped to clear the ground. It is easy to ameliorate. The man of genius lays the foundations, while the elaborate superstructure raised by his followers long after his time hides from their view the fact that he has made their part possible.

In giving the synonymy of species which have become historical, which have a wide geographical range, and are to be found in monographs, books of travel, lists, hand-books, it becomes a necessity to cull the long list of quotations misnamed Synonymes, and to separate what is merely bibliographical from what constitutes the history of the name and the history of the species. In the history of the species we need all the possible combinations which have been recorded as expressing its affinities, but for the history of the name we must frequently go back to earlier dates and consult books where we find no information of any value. If the practice were adopted generally of giving only such quotations as enable us to gain some kind of information, a better description, notes of the geographical distribution, anatomical or physiological points of interest, we should, little by little, get rid of an evil which is daily becoming more intolerable. We can hardly expect our successors to continue to drag this dead weight, and the sooner we get the benefits of a similar course the better. There are two principal points of interest, the starting-point, or the original name, and the present interpretation, or the name we adopt. The one is the variable quantity, the other its value, in our estimation, for the special case under consideration. Is it necessary that we should always go through all the details of the solution of the problem? Let us adopt something, at least, from mathematics, and when we have solved such simple problems on our slate, let us rub out the figures and leave the answer; or if we must show how we have solved it, let us publish the figures on our slates separately, for the benefit of those who cannot, or will not, follow us; but let us draw a line at least, and a distinct one, between the bibliographical part, the name of the species, the history of the

species, and the natural history of the species. The last plays but an insignificant part too often, while the history and bibliography encroach upon the natural history, and to an alarming degree are believed to be substitutes for it. Zoölogical monographs must hereafter depend, to a great extent, upon the examination of authentic specimens, and no one has any claim to ask his peers to spend their time in testing the accuracy of his guesses. When he has examined large materials or original collections, his opinions are to be considered and criticised on other than personal grounds, "*sine ira et studio.*" All appeals to unprejudiced people on questions of nomenclature and personal criticisms, in discussing guesses on questions based most frequently upon myths, do not increase our knowledge one iota; and if careful study of materials at my command has compelled me to differ from the views generally adopted by most writers on Echinoderms, I am expressing an opinion based upon extensive materials, and I trust no one of the many friends to whom I owe the information I have been able to collect will receive my work in any but the most impersonal manner.

An attempt to carry out these views has been made in this memoir. I shall consider myself fortunate if I can succeed in persuading others to simplify their work by getting rid, to a great extent at least, of the *bête noire* of Zoölogists, and apply their time to better things. We can do this without sacrificing accuracy, or losing our hold upon the past, which is certainly an important point, but should not be maintained at the cost of preventing all future progress.

Systematic Zoölogy, viewed, as it should be, as the connecting link between the different departments constituting Biology, has a totally different meaning from mere nomenclature. It becomes an epitome of years of study, the concise expression of the thoughts of a writer on the affinities of the animals he is discussing. Systematic Zoölogists have, until lately, laid claim to be exclusively recognized as Zoölogists; they should remember, now at least, that Physiology, Comparative Anatomy, Morphology, Embryology, Palæontology, Histology, Psychology, and Geographical Distribution are as much a part of Zoölogy as the mere questions of classification and of nomenclature. Great as have been the benefits derived by following the precepts of Linnæus, we must nowadays return to old Aristotle and take him for our guide. The Aristotelian view of the whole knowledge of the life of an animal is the true conception of what Zoölogy should be; the convergence towards this broad base of Zoölogy, by workers in the different fields

mentioned above, shows the necessity of some element in common to express the variable quantities constantly obtained in various departments from a closer and more accurate examination of nature. This element systematic Zoölogy furnishes; it gives us the quantities to make our equations, and when it takes this broad form is no longer a mere dry collection of meaningless names, but becomes our interpretation of nature. The facility with which, in a new country, unknown animals can be described, the notoriety thus readily obtained, is a strong incentive to descriptive work; not that I would, as is frequently done, deny all value to systematic Zoölogy, but it should not be forgotten that the true purpose of useful systematic work must be to increase our knowledge of the relationship of animals to special groups already known, or serve in some way as a connecting link in the chain of the various branches of Zoölogy. We have our independent memoirs of systematic Zoölogy, of Psychology, of Palæontology, of Comparative Anatomy, of Histology, etc., treating of their respective sciences as isolated departments all strongly biassed by the characteristics of the sciences from which they originated. Comparative Anatomy and Physiology, as well as Histology, are the children of Human Anatomy, and this, in its turn, was gradually developed from the needs of Medicine. Embryology and Palæontology, though so intimately connected, are rarely treated together, the latter being considered to belong, by birthright, to Geology. Psychology is but now becoming emancipated from speculative Philosophy. We have no recent Zoölogical memoir in the Aristotelian sense; the sciences forming the branches of Aristotelian Zoölogy stand upon separate pedestals. They have grown up independently of one another, yet they all converge towards a common point, each an important part in the life history of every animal; and the common link which is to unite them all is (when rightly understood) systematic Zoölogy.

Working in this spirit, systematic Zoölogy helps us in our attempts to understand the laws of nature; these must remain unintelligible to him who is busy with naming and classifying materials, reducing his science to an art, merely accumulating facts to be stored in museums, forming as it were a library of nature. To him its books will be inaccessible, and its laws as inexplicable as are the laws of the motions of the planets to one who has no knowledge of the existence of gravitation.

EXPLANATION OF THE CHRONOLOGICAL LIST.

EVERYTHING relating to the *history of the name* is to be found in a CHRONOLOGICAL LIST of all the species of Echini having binomial names and all the possible combinations under which these species occur at different periods. When a name *first* appears, no matter if a new genus, or species, or a synonyme, it is printed in a special type (**Cidaris**). When the same name appears subsequently, it is printed in a different type (*Cidaris*). Each author, each paper, book, or memoir is kept separate, and receives a special heading with the quotation of the book, which holds good for all species arranged strictly chronologically. Thus in

1734.

KLEIN, Nat. Disp. Echinod. .....

Cidaris	Appears for the first time.
toreumatica!	appears for the first time.

1758.

LINNÉ. .....

Echinus	Appears previously.
rosaceus.	appears for the first time.

1776.

O. F. MÜLL. .....

Echinus	Old name.
Dröbachiensis!?	New name.

1778.

LESKE, Additamenta ad KLEIN.

Cidaris	Appears before.
papillata	New species.

1780.

Under FABRICIUS. .....

Echinus Appears previously.

saxatilis!? non RUMPH, nec LIN. nec MÜLL. = *Echinus* **Dröbachiensis** MÜLL. 1776

a combination which appears before, but represents a different species identical with a species previously described by MÜLLER in 1776.

1837.

DESMOULINS. .....

Echinolampas Appears previously.

Richardi (**Desml.**) non DESMT. = *Echinolampas* **Hellei**, VAL. 1869

shows that the *Richardi* of Desmoulins is a new species which has subsequently received the name of **Hellei** in PERRIER, Pédicellaires.

Genera are treated in the same way, but, owing to their variable limits, no attempt has been made to show which are the synonymes, and a generic name when it first appears is always printed in the heavy type, as **Scutella**, 1816, LAMARCK .....

When a generic section is proposed, which may or may not be valid, but of which the name is preoccupied, it is denoted in the following way: —

1869.

A. AGASSIZ, Bull. M. C. Z.

Lissonotus (**A. Ag.**) non SCHÖN. 1817.

If it is strictly a synonyme within the same limits of a well-defined older genus, it is denoted as follows: —

1862.

DUJ. HUPÉ, Échin. .....

Polyaster non GRAY, 1840.

the synonymy of the species giving all the necessary information.

To show that a species known previously appears again in a new genus, the following notation is adopted, if referred to a new genus: —

Clypeaster which appears for the first time under LAMARCK in 1801.

rosaceus! as an old species in a new genus. Figures afterwards in GRAY, 1825, as

Echinanthus

rosaceus! meaning that Gray transferred *rosaceus* to a genus already established previous to his time, while a new species of GRAY, of the genus *Echinanthus*, already established, is denoted thus: —

Echinanthus

testudinarius!

the (!) notation showing at once which types I have personally examined.

The only synonymy introduced in the Chronological List is the adding of the original specific name to a synonyme when it first appears. Thus, in LAMARCK, 1816, we find,

Echinus

neglectus! = *Echinus* **Dröbachiensis** MÜLL. 1776.

Showing that Lamarck described as a new species what had already been described as *Echinus* **Dröbachiensis** by MÜLLER, or that I consider it to be the same species, which may or may not be a correct view.

Typographical errors figure as new names, and are denoted as follows: under FORBES, 1844, we find,

Amphidotus (err. typ.) **Amphidetus** AGASS. 1841. The correction is at once indicated.

The light and heavy type are used throughout the book to denote the relations the specific and generic names bear to the authority of the special case, but it does not necessarily follow that because we write *Encope* **micropora**, under AGASSIZ in 1841, Mon. Scut., that the genus **Encope** was not established by him; it merely denotes that he described as belonging to *Encope* the species **micropora**, at a different period or in a subsequent paper to the one when **Encope** was first established. See 1840, AGASSIZ, Cat. Syst. Ectyp., **Encope grandis**, where the genus was first named.

In the Chronological List fossil genera have been introduced in their proper order.

CHRONOLOGICAL LIST.

ARISTOTLE, Hist. Anim., Lib. 4.

Ἔχινος.
Βρίσσος.
Σπάταγγος.
Ἐχινομῆτρα.

1554.

RONDELET, Libri de piscibus marinis, ... 1554, p. 578.

Echinus
ovarius = *Echinus* **granularis** LAM. 1816.
Echinus Spatagus et Brissus = **Spatagus purpureus** MÜLL. 1776.
Echinometra ..... = *Echinus* **melo** LAM. 1816.

1606.

ALDROVANDI, De reliquis animalibus, ... 1606.

Echinus
spatagus.
Echinometra maxima pelagica sardica = *Echinus* **melo** LAM. 1816.

1705.

G. E. RUMPH, D'Amboinske Rariteit Kammer, 1705.

Echinus
esculentus = *Cidaris* **variegata** LESKE, 1778.
saxatilis.
niger.
Echinometra
digitata prima.
" *secunda.*
setosa.
Echinus
sulcatus = *Echinanthus* **humile** LESKE, 1778.
planus = **Laganum Bonani** KLEIN, 1734, et **Scutella bifissa** LAM. 1816.

1711.

SCHYNVOET Thes. Imag. 1711, p. 2, *Pl. XIV. f. B.*

Diadema
turcarum.

1717.

MERCATI, Metallotheca, 1717.

Ananchytes.

1732.

J. P. BREYNII, De Echinis et Echinitis sive, ... 1732.

Echinometra ovalis ..... = *Echinus* **lucunter** LIN. 1758.
Echinoconus.
Echinocorys.
Echinanthus
vertice ..... = **Scutum ovatum** KLEIN, 1734.
Echinospatagus
cordiformis ..... = *Echinus* **cordatus** PENN. 1777.??
Echinobrissus.
Echinodiscus
dimidia .....
maximus ..... = *Echinus* **placenta** LIN. 1758.

1734.

J. T. KLEIN, Naturalis dispositio Echinodermatum, 1734.

Cidaris
miliaris esculenta! = *Cidaris esculenta* (**Leske**) 1778.
" *saxatilis*! = *Cidaris saxatilis* (**Leske**) 1778.
" *hemisphaerica* = *Cidaris* **hemisphaerica** LESKE, 1778.
" *angulosa*! = *Cidaris* **angulosa** LESKE, 1778.
variolata Rumphii Echinus setosus.
" *ellyptica*!
mammillata!
mauri.
assulata Aldrovandi Echinometra max. pel. Sardica = *Cidaris* **sardica** LESKE, 1778.
" *flammea* = *Cidaris* **flammea** LESKE, 1778.
" *variegata*! = *Cidaris* **variegata** LESKE, 1778.
" *pustulosa* = *Cidaris* **pustulosa** LESKE, 1778.
" *granulata* = *Cidaris* **granulata** LESKE, 1778.
bothryoides.
toreumatica!
Clypeus.
Fibula.
Conulus.
Discoides.
Cassis.
Galea.
Galeola.
Scutum
angulare humile! = *Echinanthus* **humile** LESKE, 1778.
ovatum.
Placenta
Mellita
laevis.
testudinata!
Laganum
Bonani!
Rumphii!

1734. KLEIN (*continued*).

Placenta
Rotula
Augusti!
Rumphii!
Arachnoides.
Cor Marinum
Spatangus
π graecum.
Spatagoides.
Ovum Marinum
Brissus
maculosus angustus ! = *Echinus* **maculosus** GMEL. 1788.
" *ventricosus* = *Spatangus* **ventricosus** LAM. 1816.
unicolor!
Brissoides.

1742.

GUALTIERI, Index testarum conchyliorum, 1742.*

Echinometra
compressa.....
Echinanthus
ovalis.....
Echinodiscus
subrotundus.....

1745.

C. LINNÉ, Fauna Suecica, 1745.

Echinus
subglobosus = *Echinus esculentus* LINN. 1758, non RUMPH.
subcompressus = *Echinus spatagus* LINN. 1758, non ALDROV.

1756.

LANG, Lapid. figur..... 1756.

Echinometrites.

1758.

SEBA, Locuplet. Thesaurus..... III. 1758, p. 18, *Pl. X.-XVI.*†

Echinus indigenus = *Echinus* **miliaris** MÜLL. 1771.
oblongo-rotundus = *Echinus* **lucunter** LIN. 1778.
..... *nodiformis* = *Echinus* **punctulatus** LAM. 1816.
..... *Kermesinus* = " " " "
..... *singularis* = *Echinus* **ovatus** GMEL. 1788.
indicus ..... = *Cidaris* **angulosa**, LESKE, 1778.
..... *cordiformis* = *Echinus* **cordatus** PENN. 1777.
oblongus ..... = *Echinus* **maculosus** GMEL. 1788.
..... *orientalis* = **Scutum ovatum** KLEIN, 1734.

* The genera of Breynius were adopted by Gualtieri; he gave no binomial names, strictly speaking.

† Seba has no binomial names, yet as many of his names have been quoted as binomials, those only which have been used in this way are here given. (..... signifies a word left out.)

1758. SEBA (*continued*).

Echinus ..... *maximus* = *Echinus* **rosaceus** LIN. 1758.
americanus..... = " " " "
orientalis ..... = *Cidaris esculenta* (**Leske**), 1778.
..... *purpurascens* = *Echinus* **miliaris** MÜLL. 1771.
..... *pergrandis* = *Cidaris* **pustulosa** LESKE, 1778.
aculeatus ..... = *Echinus* **subglobosus** LIN. 1745.
Echinometra orientalis = **Cidaris mammillata** KLEIN, 1734.
nigra .....
multipes .....
purpurea .....
singularissima ..... = *Cidarites* **geranioides** LAM. 1816.
setosa ..... = *Echinometra* **setosa** RUMPH. 1705.
muscosa ..... *Cidarites* **metularia** LAM. 1816.
..... *minor.*
Echionanthus major ..... = *Cidaris* **radiata** LESKE, 1778.
..... *maximus* = *Echinus* **grandis** GMEL. 1788.
maximus ..... = *Echinodiscus* **auritus** LESKE, 1778.
Echinus laganoides ..... = **Mellita testudinata** KLEIN, 1734.
planus ..... = *Echinanthus* **humile** LESKE, 1778.
Echinodiscus minuscula = **Rotula Rumphii** KLEIN, 1734.
minima .....
Echinus scutiformis ..... = *Echinus* **reticulatus** LIN. 1758.
..... *ellipticus* = **Brissus unicolor** KLEIN, 1734.

1758.

LINNÉ, Systema Naturae Ed. decima ref. 1758.

Echinus
esculentus non RUMPH. = *Echinus* **subglobosus** LINN. 1745.
globulus.
sphaeroides.
lixula.
saxatilis (**Linn.**) non RUMPH. = *Echinus* **lividus** LAM. 1816.
diadema.
cidaris.
mammillatus.
lucunter.
atratus.
spatagus non ALDROV. = *Echinus* **subcompressus** LINN. 1745.
lacunosus.
rosaceus.
reticulatus.
placenta.
orbiculus.

1764.

PETIVER, Gazophylacii Nat. et Artis Decades, 1764.

Echinus
setosus.
perexiguus = **Spatagus pusillus** MÜLL. 1776.
Echinometra
digitata = *Cidarites* **metularia** LAM. 1816.

1771.

P. L. S. MÜLLER, Deliciae Naturae, ... KNORR, 1771.

Echinus

miliaris.

Echinometra

setosa (**Müll.**) non RUMPH. = **Spatagus pusillus** MÜLL. 1776.

1774.

PALLAS, Spicilegia Zoölogica, Fas. IX. 1774.

Echinus

calamaris.

minutus.

1774.

VAN PHELSUM, Brief..... 1774.

Echinonëus.

Echinocyamus.

1776.

O. F. MULLER, Prodromus Zoöl. Dan. 1776.

Echinus

sphaera !? = *Echinus* **subglobosus** LIN. 1745.

Dröbachiensis !?

saxatilis !? non RUMPH. nec LIN. = *Echinus* **miliaris** MÜLL. 1771.

Spatagus (err. typ.) **Spatangus** KLEIN, 1734.

flavescens !?

pusillus !?

purpureus !?

Pedicellaria.

1777.

PENNANT, British Zoölogy, IV. 177., p. 58, *Pl. XXXIV. f. 2.*

Echinus

cordatus.

1778.

LESKE, Additamenta ad Klein, ... 1778.

Latin Translations of Van Phelsum's names.

*Echinosinus.**

Echinites.

Echinodiscoides.

Echinoplacos.

Echinomitra.

Echinorodum.

Amygdala.

* These names are universally attributed to VAN PHELSUM. LÜTKEN first showed that VAN PHELSUM only proposed two genera, **Echinonëus** and **Echinocyamus**, LESKE giving Latin names, without adopting them however, to the subdivisions of VAN PHELSUM which had received from him only vernacular appellations. AGASSIZ, GRAY, and other writers have even quoted VAN PHELSUM for specific names, these are also nothing but LESKE's Latin translations of VAN PHELSUM's names, as in the case of the genera; they are here given as they appear.

1778. LESKE (*Latin translations continued*).

Ova.
Nuces.
Campana.
Echinocardium.
Echinophora.
Echinus coniformis = *Cidaris esculenta* (**Leske**), 1778.
decemradiatus = " " " "
Carduum marinum = *Cidaris* **Basteri** LESKE, 1778.
Echinus pentagonus = *Cidaris* **angulosa** LESKE, 1778.
Echinometra subrotunda = *Cidarites* **metularia** LAM. 1816.
latefasciata = *Cidarites* **imperialis** LAM. 1816.
Cometa parva = *Cidaris* **stellata** LESKE, 1778.
magna = *Cidaris* **radiata** LESKE, 1778.
Echinometra violacea = *Echinus* **atratus** LIN. 1758.
Echinoglycus irregularis = **Mellita laevis** KLEIN, 1734.
Echinotrochus perforatus = *Echinodiscus* **sexiesperforatus** LESKE, 1778.
Echinoglycus frondosus = *Echinodiscus* **emarginatus** LESKE, 1778.
auritus = *Echinodiscus* **auritus** LESKE, 1778.
inauritus = *Echinodiscus* **auritus** LESKE, 1778.
oblique = *Echinodiscus* **emarginatus** LESKE, 1778.
pentagonus = *Echinus* **reticulatus** LIN. 1758.
ovalis = *Echinus* **reticulatus** LIN. 1758.
Echinotrochus octodigitatus = **Rotula Augusti** KLEIN, 1734.

1778.

N. P. LESKE, Addit. Klein, 1778.

Cidaris
esculenta (**Leske**) non RUMPH. nec LIN.
saxatilis " " " = *Echinus* **miliaris** MÜLL. 1771.
Basteri.
hemisphaerica.
angulosa.
diadema.
Cidarites.
Cidaris
subangularis.
fenestrata pars = *Echinus* **atratus** LIN. 1758.
lucunter.
rupestris.
calamaris.
araneiformis.
stellata.
radiata.
violacea = *Echinus* **atratus** LIN. 1758.
papillata.
sardica.
flammea.
variegata.
pustulosa.
granulata = *Echinus* **globulus** LIN. 1758.

1778. LESKE (*continued*).

Echinoneus
cyclostomus.
minor.
Echinocorytes
Echinanthus
humile.
ovatus.
Echinanthites.
Echinodiscus
bisperforatus = Mellita laevis KLEIN, 1734.
quinquiesperforatus = Mellita testudinata KLEIN, 1734.
sexiesperforatus.
emarginatus.
auritus
inauritus = *Echinodiscus* **auritus** LESKE, 1778.
quaterperforatus = *Echinodiscus* **emarginatus** LESKE, 1778.
laganum = Laganum Bonani KLEIN, 1734.
reticulatus.
orbicularis.
deciesdigitatus = Rotula Augusti KLEIN, 1734.
octiesdigitatus = " " " "
dentatus = Rotula Rumphii KLEIN, 1734.
Echinocyamus
nucleo cerasi = *Echinus* **minutus** PALL. 1774.
ervum = " " " "
vertice centrali = " " " "
craniolaris = " " " "
turcicus = " " " "
vicia = Spatagus pusillus MÜLL. 1776.
ovatus = *Echinus* **minutus** PALL. 1774.
lathyrus = " " " "
equinus = " " " "
angulosus = Spatagus pusillus MÜLL. 1776.
ovalis = " " " "
inaequalis = *Echinus* **minutus** PALL. 1774.
cor ranae = " " " "
cor raninum = " " " "
Echinarachnius
placenta.
Spatangus
lacunosus.
pusillus.
purpureus.
Brissus
" *var. maculosus.*
" " *unicolor.*
" " *ovatus.*
" " *late carinatus* = *Echinus* **carinatus** GMEL. 1788.
ovatus.
Spatangites.

1780.

FABRICIUS, Fauna Groenland. 1780, No. 368.

Echinus

saxatilis non RUMPH. nec LIN. nec MÜLL. = *Echinus* **Dröbachiensis** MÜLL. 1776.

1782.

MOLINA, Saggio sulla storia naturale del Chili, 1782.

Echinus

albus.

niger (**Mol.**) non RUMPH.

1782.

BONANNI, Rer. Nat. Historia, 1782, p. 9, *Pl. VI. f. 33.*

Echynus (err. typ.) **Echinus.**

complanatus = Laganum Bonani KLEIN, 1734.

1788.

GMELIN, LINN. Syst. Nat. 1788.

Echinus

Basteri.

hemisphaericus.

angulosus.

gratilla.

subangularis.

fenestratus.

araneiformis.

stellatus.

radiatus.

assulatus.

sardicus.

flammeus.

variegatus.

pustulosus.

granulatus.

toreumaticus.

cyclostomus.

semilunaris = *Echinoneus* **minor** LESKE, 1778.

scutiformis non VAN PHEL. = *Echinus* **reticulatus** LIN. 1758 (pars).

oviformis = Scutum ovatum KLEIN, 1734.

biforis = Mellita laevis KLEIN, 1734.

pentaporus = Mellita testudinata KLEIN, 1734.

hexaporus = *Echinodiscus* **sexiesperforatus** LESKE, 1778.

emarginatus.

auritus.

inauritus.

tetraporus = *Echinodiscus* **emarginatus** LESKE, 1778.

laganum.

orbicularis.

decadactylos = Rotula Augusti KLEIN, 1734.

octodactylos = " " " "

nucleus = *Echinus* **minutus** PALL. 1774.

centralis = " " " "

1788. GMELIN (*continued*).

Echinus
- *arvum.*
- *cranialaris.*
- *turcicus.*
- *vicia.*
- **ovulum** = *Echinus* **minutus** PALL. 1774.
- *lathyrus.*
- *equinus.*
- **faba** = *Echinus* **minutus** PALL. 1774.
- *inaequalis.*
- **raninus** = *Echinus* **minutus** PALL. 1774.
- **bufonius** = " " " "
- *purpureus.*
- *pusillus.*
- **maculosus.**
- **major** = *Echinus* **maculosus** GMEL. 1788.
- **nodosus.**
- **orthopetalus** = **Brissus unicolor** KLEIN, 1734.
- *unicolor.*
- **ovatus.**
- **carinatus.**
- **grandis.**

1789.

ABILDGAARD, Zoöl. Danica, 1789.

Spatangus
- *pusillus*!? non LESKE nec MÜLL. Prod.
- *flavescens.*

1801.

LAMARCK, Système des Animaux sans Vertèbres, 1801.

Galerites.
Nucleolites.
Cassidulus
- **caribaearum**!

Clypeaster
- *rosaceus*!
- *pentaporus*!

1812.

PENNANT, British Zoölogy, 2d Ed. 1812, p. 140, *Pl. XXXVIII. f. 1–4.*

Echinus
- **pulvinulus** = **Spatagus pusillus** MÜLL. 1776.

1815.

LEACH, Zoöl. Miscell. II. 1815, p. 68, *Pl. LXXXII.*

Spatangus.
- **Australasiae.**

1816.

LAMARCK, An. s. Vert. 1816.

Scutella

dentata !
digitata ! = **Rotula Augusti** KLEIN, 1734.
emarginata !
sexforis ! = *Echinodiscus* **sexiesperforatus** LESKE, 1778.
quinquefora ! = **Mellita testudinata** KLEIN, 1734.
quadrifora = *Echinodiscus* **emarginatus** LESKE, 1778.
bifora ! = **Mellita laevis** KLEIN, 1734.
bifissa = *Echinodiscus* **auritus** LESKE, 1778.
orbicularis ! (**Lamk.**) non LESKE.
placenta !
parma !
placunaria ! = *Echinanthus* **humile** LESKE, 1778.
latissima !
ambigena ! = *Echinanthus* **humile** LESKE, 1778.

Clypeaster

scutiformis !
laganum !
oviformis !

Fibularia

trigona !? = *Echinus* **minutus** PALL. 1774.
ovulum !
tarentina !? = **Spatagus pusillus** MÜLL. 1776.

Echinoneus

semilunaris !
gibbosus ! = *Echinoneus* **cyclostomus** LESKE, 1778.

Spatangus

pectoralis ! = *Echinus* **grandis** GMEL. 1788.
ventricosus !
carinatus !
columbaris ! = *Echinus* **ovatus** GMEL. 1788.
compressus ! = *Echinus* **maculosus** GMEL. 1788.
Crux Andreae ! = *Spatangus* **Australasiae** LEACH, 1815.
sternalis !
planulatus !
canaliferus ! = *Echinus* **lacunosus** LIN. 1758.
atropos !
arcuarius ! = *Echinus* **cordatus** PENN. 1777.

Cassidulus

australis ! = **Cassidulus caribeearum** LAMK. 1801.

Echinus

ventricosus ! = *Cidaris esculenta* (**Leske**), 1778.
granularis !?
virgatus !? = *Cidaris* **sardica** LESKE, 1778.
globiformis ! = *Echinus* **subglobosus** LIN. 1745.
fasciatus ! = *Cidaris* **sardica** LESKE, 1778.
pileolus !
melo !
acutus !
pentagonus ! = *Cidaris* **sardica** LESKE, 1778.

1816. LAMARCK (*continued*).

Echinus

obtusangulus! = *Echinus* **pileolus** LAM. 1816.
polyzonalis! = " " " "
maculatus!
variolaris!
margaritaceus!
sculptus! = **Cidaris toreumatica** KLEIN, 1734.
punctulatus!
ovum!
pallidus!
variegatus! (**Lam.**). non LESKE.
subangulosus! = *Cidaris* **angulosa** pars LESKE, 1778.
subcoeruleus! = *Cidaris* **sardica** LESKE, 1778.
neglectus! = *Echinus* **Dröbachiensis** MÜLL. 1776.
lividus! = *Echinus saxatilis* (**Lin.**) 1758, non RUMPH. nec MÜLL.
tuberculatus!
lucunter! (**Lam.**) non LIN.
trigonarius!

Cidarites

imperialis!
pistillaris! = *Cidarites* **baculosa** LAMK. 1816.
hystrix! = *Cidaris* **papillata** LESKE, 1778.
baculosa!
geranioides!
tribuloides!
metularia!
verticillata!
tubaria!
bispinosa!
annulifera!
spinosissima! = **Diadema turcarum** SCHYN. 1711.
calamaria!
subularis! = **Diadema turcarum** SCHYN. 1711.
diadema! (**Lam.**) non LIN.
pulvinata!
radiata!

1817.?

FLEMING, Wern. Mem. 1817?, II. 246.

Echinus

miliaris non MÜLL. nec RISSO = *Echinus* **acutus** LAM. 1816.

1820.

DE FRANCE, Article Fibulaire, Dict. Scienc. Nat. XVI. 1820.

Fibularia

nucleum.
craniolaris.
turcicus.
vicia.

1820. De France (*continued*).

Fibularia
ovatus.
latyrus (err. typ.) **lathyrus.**
angulosa
minutus.
ovalis.
inaequalis.

1824.

Eudes DesLongchamps, Enc. Méth. Vers. II. 1824.

Echinus
solaris Val. = **Rotula Rumphii** Klein, 1734.
hura.
margaritaceus non Lam. = *Cidaris* **pustulosa** Leske, 1778.
punctiferus = *Echinus* **globulus** Lin. 1758.
attenuatus.
elegans = **Cidaris toreumatica** Klein, 1734.
Cassidulus
Richardii = **Cassidulus caribæarum** Lam. 1801.
Fibularia
nucleola = *Echinus* **minutus** Pall. 1776.
Scutella
integra.
porpita = *Echinus* **placenta** Lin. 1758.

1824.

Fleming, Wern. Mem. 1824, V. 287.

Spatangus
ovatus non Leske, nec Lam. = **Spatagus flavescens** Müll. 1776.

1825.

Blainville, Dict. Scienc. Nat..... Oursin, 1825.

Echinus
loculatus! = *Cidaris* **pustulosa** Leske, 1778.
stellatus! (**Blainv.**) non Gmel.
aequituberculatus!
Dufresnii!
pseudomelo! = *Echinus esculentus* (**Lin.**) 1758, non Rumph.
quinqueangulatus!? " " " " " "
auranticus!? " " " " " "
violaceus!? " " " " " "
paucituberculatus! = *Echinus* **variolaris** Lam. 1816.
minimus! = *Cidaris* **angulosa** Leske, 1778.
excavatus! = *Echinus variegatus* (**Lam.**) 1816, non Leske.
trizonalis! = *Echinus* **pileolus** Lam. 1816.
depressus! = *Echinus* **maculatus** Lam. 1816.
vulgaris!? = *Echinus saxatilis* (**Lin**) 1758, non Rumph. nec Müll.
Gaimardi!
equituberculatus! = *Echinus* **granularis** Lam. 1816.
dubius!? = " " " "

1825. BLAINVILLE (*continued*).

Echinus

microtuberculatus !
molaris ! = *Echinometra* **setosa** RUMPH. 1705.
longispina ! = *Echinometra* **setosa** RUMPH. 1705.
subglobiformis ! = *Echinus* **granularis** LAM. 1816.
inflatus ! = *Cidaris* **variegata** LESKE, 1778.
Peronii ! = " " " "
Leschenaulti ! = *Echinus* **variolaris** LAM. 1816.
Maugei ! = *Echinus lucunter* (**Lam.**) 1816. non LIN.
Mathaei ! = " " " " "
acufer ! = *Echinus* **lucunter** LIN. 1758.
oblongus !
lobatus !? = *Echinus* **lucunter** LIN. 1758.
Quoy ! = *Echinus* **atratus** LIN. 1758.
pedifer ! = " " " "

1825.

DELLE CHIAJE, Mem. s. Stor. e. Not. degl. An. senz. Verteb. 1825, *December*.

Echinus

neapolitanus = *Cidaris* **pustulosa** LESKE, 1778.
spatagus non LIN. = **Brissus unicolor** KLEIN, 1734.
ventricosus non LAM. = *Echinus* **melo** LAM. 1816.

1825.

J. E. GRAY,..... Ann. Phil. 1825.

Cidaris

imperialis !

Diadema

setosa ! (**Gray**) non RUMPH.
calamaria !

Astropyga

radiata !

Echinometra

lucunter !
mammillata !
atrata !

Echinanthus

rosaceus !
subdepressa !
ambigena.

Lagana (err. typ.) **Laganum** KLEIN, 1734.

laganum !
scutiformis !
minor.

Echinarachnius

parma !

1825. GRAY (*continued*).

Echinodiscus
bifora !
digitata !
octodactylus !
Echinocyamus
ovulum
pusillus !
tarentina
trigona
Discoidea (err. typ.) **Discoides** KLEIN, 1734.
Echinanaus (err. typ.) **Echinonëus** VAN PHEL. 1774.
cyclostomus !
Echinolampas
oviformis !
orientalis = **Scutum ovatum** KLEIN, 1734.
Echinocardium
atropos !
pusillus
Seba ! = *Echinus* **cordatus** PENN. 1777.
Brissus
ventricosus !
carinatus !
columbaris !
Ova
canaliferus !

1826.

RISSO, Hist. Nat. Prod. Europ. Mérid. 1826, V. p. 276.

Echinus
sardicus non GMEL. nec LAM. = *Echinus* **melo** LAM. 1816.
miliaris non MÜLL. nec FLEM. = *Echinus* **microtuberculatus** BLAINV. 1825.
purpureus non MÜLL. nec GMEL. = *Echinus saxatilis* (**Lin.**) 1758, non RUMPH.
brevispinosus = *Echinus* **granularis** LAM. 1816.
Spatangus
carinatus non LAM. = **Brissus unicolor** KLEIN, 1734.
meridionalis = **Spatagus purpureus** MÜLL. 1776.

1827.

BLAINVILLE, Article Scutelle, Dict. Scienc. Nat. 1827, XLVIII.

Scutella
Rumphii !
semisol ! = **Rotula Rumphii** KLEIN, 1734.
decadactylos.
octodactylos.
reticulatus.
laganum !
clypeastriformis ! ? = *Echinus* **reticulatus** LIN. 1758.
decagonalis LESS. !

1827.

BLAINVILLE, Article Spatangue, Dict. Scienc. Nat. 1827, L. p. 87.

Spatangus

grandis

Gualterii = *Echinus* **lacunosus** GMEL. 1788.

1827.

SAY, Journ. Acad. Phila. 1827, p. 225.

Echinus

granularis!? non LAM. = *Echinus* **Dröbachiensis** MÜLL. 1776.

Scutella

pentaphora!? = **Mellita testudinata** KLEIN, 1734.

trifaria!? = **Scutella parma** LAM. 1816.

1828.

FLEMING, Brit. Anim. 1828.

Echinus

subangularis non LESKE = *Echinus* **Dröbachiensis** MÜLL. 1776.

Spatangus

cordatus.

1830.

BLAINVILLE, Zoophytes Dict. Scienc. Nat. 1830, LX.

Spatangus

unicolor.

Echinoclypeus.

Echinocyamus

minutus!?

Lagana

ovalis! = *Echinus* **scutiformis** GMEL. 1778.

orbicularis!

decagona LESS. (err. typ.) *Scutella* **decagonalis** LESS.

Clypeaster

ambigenus!

Echinodiscus

placunaria!

latissima!

placenta!

parma!

Rumphii!

Scutella

hexapora!

pentapora! = **Mellita testudinata** KLEIN, 1734.

biforis!

tetrapora.

aurita!

inaurita!

octodactyla!

decadactyla.

radiata! = **Rotula Rumphii** KLEIN. 1734.

1830. BLAINVILLE (*continued*).

Echinometra
- *Leschenaulti* !
- *Maugei* !
- *Mathaei* !
- *acufera* !
- *oblonga* !
- *lobata* !
- *Quoyii* !
- *pedifera* !,
- *carinata* !
- *trigonaria* !

Echinus
- **parvituberculatus** = *Echinus* **microtuberculatus** BLAINV. 1825.
- **mola** (err. typ.) **molaris** BLAINV. 1825.
- *minutus* (err. typ.) **minimus** BLAINV. 1825.
- **quinqueangulosus** (err. typ.) **quinqueangulatus** BLAINV. 1825.

Cidaris
- *hystrix* !
- *geranioides* !
- *pistillaris* !
- *calamaria* !
- *metularia* !
- *tribuloides* !

1833. ?

ESCHSCHOLTZ, Zoöl. Atl. ..... 1833 ?, *Pl. XX. f. 1, a.*

Scutella
- **excentrica.**
- **quinqueloba** = *Echinodiscus* **emarginatus** LESKE, 1778.

1835.

J. E. GRAY, Proc. Zoöl. Soc. London, 1835, *April.*

Arbacia
- *pustulosa.*
- *punctulata* !
- *loculata.*
- *stellata.*
- **equituberculata** (err. typ.) *aequituberculata.*
- *Dufresnii.*

Salenia.

Echinometra
- *miliaris* !
- *paucituberculata.*
- *minuta.*
- *ovum.*
- *pallida.*
- *grisea.*
- *livida.*
- *parvituberculata.*
- *mola.*
- *longispina.*
- *subglobiformis.*
- *variolaris.*
- *tuberculata.*

1835.

BRANDT, Prodromus, ... 1835, *May.*

Echinus

Strongylocentrotus

chlorocentrotus ! = *Echinus* **Dröbachiensis** MÜLL. 1776.

lividus.

parvituberculatus.

mola.

longispina.

subglobiformis.

tuberculatus.

Heterocentrotus

carinatus.

Postellsii = **Cidaris mammillata** KLEIN, 1734.

trigonarius.

mammillatus.

taeniatus = *Echinus* **trigonarius** LAM. 1816.

Colobocentrotus

Mertensii.

Leskei = *Echinus* **atratus** LIN. 1758.

Quoyi.

pedifer.

Cidarites

Phyllacanthus

dubia.

imperialis.

hystrix.

geranioides.

pistillaris.

tribuloides.

1835.

DESMOULINS, Tableau Analytique, 1835, *July.*

Pyrina.

Echinocidaris.

Collyrites.

1836.

L. AGASSIZ, Prodrome, 1836, *July.*

Echinocrinus.

Dysaster.

Holaster.

Hemipneustes.

Micraster

canaliferus !

lacunosus

Amphidetus

Sebae

pusillus.

Brissus

pectoralis !

1836. L. AGASSIZ (*continued*).

Brissus
Scillae ! — **Brissus unicolor** KLEIN, 1734
compressus !
sternalis !
Schizaster
atropos !
Catopygus.
Pygaster.
Clypeaster
subdepressus.
Echinarachnius
placunarius !
latissimus !
Rumphii !
Diadema
spinosissimum
subulare !
pulvinatum !
Cidaris
annulifera !

1836.

MILNE-EDWARDS, Cuv. Règ. An. Ed. III. 1836.

Nucleolites
recens !

1837.

DESMOULINS, Tableaux Syn. 1837.

Clypeaster
incurvatus = *Echinus* **reticulatus** LIN. 1758 (pars).
rangianus = *Echinanthus* **subdepressus** GRAY, 1825.
reticulatus.
Rumphii = *Echinanthus* **humile** LESKE, 1778.
Scutella
bifora non LAM. = **Mellita laevis** KLEIN, 1734.
bilinearifora = **Scutella bifora** LAM. 1816.
cassidulina = *Echinodiscus* **emarginatus** LESKE, 1778.
Fibularia
australis.
Galerites
echinonea = *Echinoneus* **cyclostomus** LESKE, 1778.
Echinometra
Blainvillii = **Cidaris mammillata** KLEIN, 1734.
pugionifera = *Echinus* **trigonarius** LAM. 1816.
subangularis.
Postelsii.
Mertensii.
Echinus
Blainvillii = *Echinus variegatus* (**Lam.**) 1816, non LESKE.
auguifer = *Echinus* **variolaris** LAM. 1816.
Echinocidaris
pustulosa.

1837. DESMOULINS (*continued*).

Echinocidaris
punctulata.
loculata.!
stellata.
aequituberculata.
Dufresnii.
Diadema
stellatum.
Desmarestii = *Echinus* **variolaris** LAM. 1816.
radiatum.
Cidaris
dubia.
Echinolampas
Richardi (**Desml.**) non DESMT. = *Echinolampas* **Hellei** VAL. 1869 in PERR.
Nucleolites
Richardi.
Spatangus
Rumphii = *Echinus* **maculosus** GMEL. 1788.
Reaumurii = *Echinus* **cordatus** PENN. 1777.

1838.

L. AGASSIZ, Mon. Éch. Salén. 1838.

Goniopygus.
Peltastes.
Goniophorus.

1839.

L. AGASSIZ, Échin. Foss. Suiss I. 1839.

Pygorhynchus.
Conoclypus.
Pygurus.
Hyboclypus.

1840.

MCCLELLAND, Calcu. Journ. N. H. I. 1840, p. 155, *July.*

Cyrtoma.

1840.

J. E. GRAY, Syn. Cont. Brit. Mus. 1840, *November.*

Hipponoë.
Colobocentrus (err. typ.) **Colobocentrotus** BRANDT, 1835.
Heterocentrus (err. typ.) **Heterocentrotus** BRANDT, 1835.

1840.

L. AGASSIZ, Échin. Suiss. II. 1840.

Tetragramma.
Acrocidaris.
Pedina.

1840. L. AGASSIZ (*continued*).

Acrosalenia.
Hemicidaris.
Arbacia (**Agass.**) non GRAY.
Glypticus.

1840.

L. AGASSIZ, Cat. Syst. Ectyp. 1840.

Toxaster.
Brissopsis.
Nucleopygus.
Globator.
Caratomus.
Amblypygus.
Heliophora.
Amphiope.
Encope
grandis.
Echinopsis.
Cyphosoma (**Agass.**) non MANN. 1837.
Acropeltis.
Coelopleurus.
Codiopsis.
Podophora
atrata !
Acrocladia
mammillata !

1841.

GOULD, Rep. Inv. Mass. 1841, p. 344.

Echinus
granulatus ! non GMEL. = *Echinus* **Dröbachiensis** MÜLL. 1776.

1841.

FORBES, British Starfishes, 1841.

Echinus
Flemingii ! ? BALL = *Echinus* **acutus** LAM. 1816.
Brissus
lyrifer ! ?
Amphidotus (err. typ.) **Amphidetus** AGASS. 1836.
cordatus ! ?
roseus ! ? — **Spatagus flavescens** MÜLL. 1776.

1841.

SISMONDA, Mém. Acad. Turin. 1841.

Anaster.

1841.

L. AGASSIZ, Int. Mon. Scut. 1841, *July*.

Temnopleurus
toreumaticus !
Cidaris
bothryoides (**Agass.**) non KLEIN,
Pleurechinus
bothryoides !
Echinus
versicolor ! VAL. = *Echinus* **globulus** LIN. 1758.
Microcyphus
versicolor !
Tripneustes
ventricosus !
Amblypneustes
griseus !
Toxopneustes
pileolus !
Stomopneustes
variolaris !
Tetrapygus.
Agarites.

1841.

L. AGASSIZ, Mon. Scut. 1841.

Rotula
digitata !
Runa
Mellita
quinquefora !
hexapora !
similis ! = *Echinus* **hexaporus** GMEL. 1788.
lobata ! = *Echinodiscus* **emarginatus** LESKE, 1778.
Encope
emarginata !
tetrapora ! (**Agass.**) non LESKE, nec GMEL. = *Encope* **micropora** AGASS. 1841.
micropora !
perspectiva ! = *Encope* **micropora** AGASS. 1841.
cyclopora = " " " "
oblonga ! = *Echinodiscus* **emarginatus** LESKE, 1778.
Valenciennesii = " " " "
subclausa ! = " " " "
Michelini !
Stokesii !
Lobophora (**Agass.**) non CURT. nec SERV.
bifora !
truncata ! = **Mellita laevis** KLEIN, 1734.
bifissa !
aurita !
Echinarachnius
atlanticus ! GRAY = **Scutella parma** LAM. 1816.

1841. L. AGASSIZ (*continued*).

Arachnoides
placenta !
Scutellina.
Laganum
depressum ! LESS.
ellipticum = *Laganum* **depressum** LESS. 1841.
decagonum ! = *Scutella* **decagonalis** LESS. 1827.
Tonganense ! Q. G. = *Laganum* **depressum** LESS. 1841.
Lesueuri ! VAL. = *Scutella* **decagonalis** LESS. 1827.
elongatum !
rostratum !
orbiculare !
marginale ! = *Echinodiscus* **orbicularis** LESKE, 1778.
stellatum ! = *Laganum* **Peronii** AGASS. 1841.
Peronii !
Moulinia
cassidulina !

1841.

L. AGASSIZ, Introd. VALENT. Anat. Genre Echinus, 1841, *December.*

Echinus
albidus ! = *Echinus saxatilis* (**Lin.**) 1758, non RUMPH.
pustulatus ! = *Echinus* **miliaris** MÜLL. 1771.
pulchellus ! = *Echinus* **microtuberculatus** BLAINV. 1825.
decoratus ! = " " " "
Microcyphus
maculatus !
Salmacis
bicolor !
Tripneustes
subcoeruleus !
obtusangulus !
Amblypneustes
ovum !
Cidaris
granulata ! (**Agass.**) non LESKE.
Holopneustes
granulatus !
Toxopneustes
tuberculatus !

1842.

DESOR, AGASS. Mon. Éch. Galérites, 1842.

Echinoneus
cruciatus ! AGASS. = *Echinoneus* **cyclostomus** LESKE, 1778.
elegans ! = *Echinoneus* **minor** LESKE, 1778.
serialis ! = *Echinoneus* **cyclostomus** LESKE, 1778.
conformis ! = *Echinoneus* **minor**, LESKE, 1778.
Holectypus.

1842.

RAVENEL, J. A. N. Scienc. Phila. 1842, p. 333.

Scutella

caroliniana = *Echinodiscus* **sexiesperforatus** LESKE, 1778.

1843.

J. E. GRAY, Deiff. Voy. II. 1843, p. 265.

Echinarachnius

zelandiae !? = *Echinus* **placenta** LIN. 1758.

1843.

CONRAD, Proc. Phila. Ac. N. Sc. 1843, p. 327.

Spatangus

orthonotus = *Echinocardium* **pennatifidum** NORM. 1867?

1844.

L. AGASSIZ, Bull. Soc. Géol. Fr. 1844, p. 730, *August.*

Metaporhinus.

1844.

McCOY, Synopsis Carb. Lim. foss. Ireland, 1844, p. 173.

Palaechinus SCOUL.
Archeocidaris.
Diplopodia.

1844.

FORBES, Proc. Lin. Soc. 1844, p. 183, *January.*

Amphidetus

mediterraneus.

1844.

MICHELIN, Rev. Mag. Zoöl. 1844, p. 173, *Mai.*

Diadema

Desjardinsii ! = **Diadema turcarum** SCHYN. 1711.

1844.

DÜBEN och KOREN, Öfvers. af K. Vetensk. Ak. Förh. 1844.

Cidaris

borealis ! = *Cidaris* **papillata** LESKE, 1778.

1845.

MICHELIN, Rev. Mag. Zoöl. 1845, *January.*

Diadema

Savignyi ! = *Diadema setosa* **(Gray,)** 1825, non Rumph.

Cidarites

papillaris ! = *Cidarites* **baculosa** LAM. 1816.

1845.

PHILIPPI, Wieg. Archiv. I. 1845.

Spatangus
Tripylus
excavatus!
cavernosus!
australis!
Brissus
pulvinatus = *Brissus* **lyrifer** FORBES, 1841.
placenta = **Brissus unicolor** KLEIN, 1734.
Cidaris
affinis = *Cidaris* **papillata** LESKE, 1778.
Diadema.
tenuispina = *Cidarites diadema* (**Lam.**) 1816.
longispina!?
antillarum = *Cidarites diadema* (**Lam.**) 1816.

1845.

RAVENEL, Jour. A. N. S. Phila. 1845, p. 253.

Scutella
gibbosa! non RISSO nec SERRES. = *Echinanthus* **subdepressus** GRAY, 1825.

1845.

J. E. GRAY, in Eyre, Voyage, I. 1845, p. 436.

Spatangus
subcarinatus!
elongatus!

1846.

DÜBEN OCH. KOREN, Skand. Ech. 1846.

Echinus
norvegicus!
elegans! (**Düb. Kor.**) non DESL. 1824.
virens! = *Echinus* **miliaris** MÜLL. 1771.
Brissus
fragilis!

1846.

OWEN and NORWOOD, Sill Journ. 1846, p. 225, *September.*

Melonites.

1846.

J. MÜLLER, Müll. Archiv, 1845, p. 101.

Pluteus.

1846.

VALENCIENNES, Voyage Vénus, Zooph. 1846, *Pls.* .....

Agassizia
scrobiculata!
Amblypneustes
pallidus!
formosus

1846. VALENCIENNES (*continued*).

Echinus
porosus ! = *Echinus* **albus** MOL. 1782.
omalostoma = *Echinus* **tuberculatus** LAM. 1816.
eurythrogrammus !
chloroticus !
Agarites
purpurescens ! = *Echinus niger* (**Mol.**) 1782.
spatuliger !
grandinosus ! = *Cidaris* **pustulosa** LESKE, 1778.
Echinarachnius
excentricus !

1846.

L. AGASSIZ ET DESOR, Cat. Rais. Ann. Sc. Nat. 1846, p. 305, *November*.

Cidaris
Stokesii ! AG. = *Cidaris* **papillata** LESKE, 1778.
Thouarsii ! VAL.
Danae ! AG. = *Cidaris* **Thouarsii** VAL.
Lima ! AG. = *Cidarites* **baculosa** LAM. 1816.
Krohnii ! AG. = " " " "
Goniocidaris DES.
geranioides ! AGASS.
Quoyi ! VAL. = *Cidarites* **tubaria** LAM. 1816.
Palaeocidaris DES.
Astropyga
pulvinata ! AG.
calamaria ! AG.
Desorii ! AG.
spinosissima ! AG.
subularis ! AG.
Diadema
europaeum ! AG. = *Diadema* **longispina** PHIL. 1845.
turcarum ! non SCHYN. = *Cidarites diadema* (**Lam.**) 1816.
Lamarckii ! ROUSS. = *Diadema setosa* (**Gray**), 1825.
Hemidiadema AG.
Echinocidaris
Agarites
punctulata ! AG.
stellata ! AG.
Dufresnii ! AG.
loculata ! AG.
Tetrapygus
niger ! AG.
aequituberculatus ! AG.
pustulosus ! AG.
grandinosus ! AG.
Eucosmus AG.
Mespilia DES.
globulus ! AG.

1846. L. AGASSIZ ET DESOR (*continued*).

Microcyphus
Rousseaui ! AG. = *Microcyphus* **maculatus** AGASS. 1841.
zigzag ! AG.
Salmacis
sulcatus ! AG.
virgulatus ! AG. = *Salmacis* **sulcatus** AG. 1846.
rarispinus ! AG.
varius ! AG. = *Salmacis* **rarispinus** AG. 1846.
Dussumieri ! AG.
globator ! AG.
Temnopleurus
Reynaudi ! AG.
bothryoides ! AG.
Polycyphus AG.
Amblypneustes
textilis ! AG. = *Echinus* **ovum** LAM. 1816.
scalaris ! AG. = *Amblypneustes* **formosus** VAL. 1846.
serialis !? AG. = *Echinus* **ovum** LAM. 1816.
Boletia DES.
pileolus ! DES.
heteropora ! DES. = *Echinus* **pileolus** LAM. 1816.
maculata ! DES.
bizonata ! DES. = *Echinus* **pileolus** LAM. 1816.
Tripneustes
sardicus ! AG.
pentagonus ! AG.
Holopneustes
porosissimus ! AG. = *Cidaris granulata* (**Agass.**) 1841, non LESKE.
Echinus
Toxopneustes
brevispinosus !
granularis !
Dröbachiensis !
albidus ! AG.
lividus !
concavus ! AG. = *Echinus saxatilis* (**Lin.**) 1758.
gibbosus ! VAL.
Delalandi ! VAL. = *Echinus* **eurythrogrammus** VAL. 1846.
neglectus ! = *Echinus* **Dröbachiensis** MÜLL. 1776.
complanatus ! VAL. = *Echinus* **lividus** LAM. 1816.
granulatus ! AG.
Dubenii AG. = *Echinus* **Dröbachiensis** MÜLL. 1776.
Psammechinus
variegatus !
semituberculatus ! VAL.
subangulosus !
norvegicus !
miliaris !
microtuberculatus !
Korenii ! DES. = *Echinus* **miliaris** MÜLL. 1771.

1846. L. Agassiz et Desor (*continued*).

Echinus
Psammechinus
excavatus !
Echinus
laganoides Des. = *Echinometra* **setosa** Rumph. 1705.
Heliocidaris Desml.
variolaris ! Desml.
paucituberculata ! Desml.
chlorotica ! Desml.
margaritacea !
eurythrogramma ! Des.
omalostoma ! Des.
mexicana ! Ag. = *Echinus* **lucunter** Lin. 1758.
Echinometra
heteropora ! Ag. = *Echinus lucunter* (**Lam.**) 1816.
Michelini ! Des. = *Echinus* **lucunter** Lin. 1758.
Acrocladia
trigonaria ! Ag.
hastifera ! Ag. = **Cidaris mammillata** Klein, 1734.
Blainvillei ! Ag. = " " " "
Podophora
pedifera ! Ag.

1847.
L. Agassiz, in Desor, Bull. Soc. Géol. France. IV. 1847, p. 287.
Monophora.

1847.
Duchassaing, Bull. Soc. Géol. France, 1847, *June.* ??
Clypeaster
parvus = *Echinus* **rosaceus** Lin. 1758.
Cassidulus
guadeloupensis = Cassidulus caribæarum Lam. 1801.

1847.
L. Agassiz et Desor, Cat. Rais. Ann. Sc. Nat. 1847, p. 5, *March.*
Laganum
attenuatum ! Ag. = *Laganum* **depressum** Less. 1841.
cingulatum ! Ag. = " " " "
latissimum !
Dendraster Ag.
excentricus ! Ag.
Lobophora
tenuissima ! Val. = **Mellita laevis** Klein. 1734.
Mellita
nummularia ! Val. = *Echinodiscus* **emarginatus** Leske, 1778.
Moulinsia (err. typ.) **Moulinia** Agass. 1841; non Gratel. 1840.
Echinocyamus
australis ! Ag.
Fibularia
volva ! Ag.
Lenita Des.

1847. L. AGASSIZ et DESOR (*continued*).

Echinoneus
crassus ! AG. = *Echinoneus* **cyclostomus** LESKE, 1778.
ventricosus ! AG. = " " " "
Pygaulus AG.
Archiacia AG.
Asterostoma AG
Spatangus
spinosissimus !? DES. = **Spatagus purpureus** MÜLL. 1776.
Macropneustes AG.
Eupatagus AG.
Valenciennesii ! AG.
Gualteria DES.
Lovenia DES.
hystrix DES. = *Spatangus* **elongatus** GRAY, 1845.
Amphidetus
cordatus ! AG.
gibbosus ! AG. = *Amphidetus* **mediterraneus** FORBES, 1844.
ovatus ! AG.
Breynia DES.
Crux Andreae ! AG.
Brissus
Plagionotus (**Agass.**) non MULS. 1842.
pectoralis !
Brissus
ventricosus !
bicinctus ! VAL. = *Spatangus* **sternalis** LAM. 1816.
dimidiatus ! AG. = **Brissus unicolor** KLEIN, 1734.
areolatus ! VAL. = *Spatangus* **sternalis** LAM. 1816.
Brissopsis
lyrifera !
cavernosa !
australis !
Hemiaster DES.
Pericosmus AG.
Agassizia
excavata ! DES.
Schizaster
canaliferus ! AG.
fragilis ! AG.
gibberulus ! AG.
cubensis ! D'ORB. = *Spatangus* **ventricosus** LAM. 1816.
Echinolampas
Laurillardi ! (**Desml.**) 1847, non DESMT. = *Echinolampas* **Hellei** VAL.; PER. 1869.

1847.

TROSCHEL in MARTENS, Wieg. Arch. 1866, I. p. 158.*

Diploporus
pyramidatus ! = *Salmacis* **sulcatus** AG. 1846.

* *Read*, Ber. der Ges. f. Nat. H. Freunde, Berlin, 1847.

1848.

RAVENEL, Ech. So. Car. 1848, *January.*

Clypeaster
prostratus = *Echinanthus* **subdepressus** GRAY, 1825.
Mellita
ampla ! HOLMES = **Mellita testudinata** KLEIN, 1734.
caroliniana.
Brissopsis
poriferus.
Amphidetus
gothicus = *Echinus* **cordatus** PENN. 1777.

1848.

J. E. GRAY, Brit. Rad. 1848, *June.*

Echinometra
Dröbachiensis !
Echinocardium
cordatus !
ovatum !
Brissiopsis (err. typ.) **Brissopsis** AGASS. 1840.
lyrifera !

1849.

McCOY, Ann. Mag N. H. 1849, p. 253.

Perischodomus.

1849.

HAIME, Ann. Sc. Nat. XII. 1849, p. 217.

Milnia.

1849.

FORBES, Q. J. Geol. Soc. London, I. 1849, p. 425.

Amphidetus
virginianus = ? *Echinocardium* **pennatifidum** NORM. 1867.

1850.

GIRARD, Proc. Bost. Soc. N. H. 1850, p. 364, *November.*

Heliechinus
Gouldii ! = *Cidaris esculenta* (**Leske**) 1778.
Melobosis
mirabilis ! = *Salmacis* **sulcatus** AG. 1846.
Psammechinus
asteroides ! = *Echinus* **chloroticus** VAL. 1846.
Echinometra
nigrina ! = *Echinus* **lucunter** LINN. 1758.
Echinocyamus
minimus ! = **Spatagus pusillus** MÜLL. 1776.
Schizaster
lachesis ! = *Spatangus* **atropos** LAM. 1816.

1850.

FORBES, Ang. Mag, N. H. VI. 1850, p. 443, *December.*

Cardiaster.

1850.

ARADAS, Monog. degli Ech. di Sicilia, Atti. Acad. Gioienia, VI. 1850, p. 55.

Amphidetus **sp. n.** = *Amphidetus* **mediterraneus** FORBES, 1844.
Schizaster
incertus = *Brissopsis lyrifera* AG. 1847.
Fibularia
equina = **Spatagus pusillus** MÜLL. 1776.

1851.

MICHELIN, Rev. Mag. Zoöl. 1851, *January.*

Encope
Agassizi! = **Eucope grandis** AG. 1841.
Haimea.

1851.

J E. GRAY, Proc. Zoöl. Soc. London, 1851, *January.*

Echinanthus
Australasiae! = *Echinanthus* **testudinarius** GRAY, 1851.
testudinarius!
oblongus! = *Echinus* **reticulatus** LIN. 1758.
productus! = *Echinanthus* **humile** LESKE, 1778.
Coleae! = *Echinus* **reticulatus** LIN. 1758.
explanatus! = *Echinanthus* **humile** LESKE, 1778.
Echinodiscus
bifissa!
Mellita
testudinaria! = (err. typ.) **Mellita testudinata** KLEIN, 1734.
erythraea!
Leodia
Richardsonii! = *Echinodiscus* **sexies perforatus** LESKE, 1778.
Fibularia
oblonga! = *Fibularia* **volva** AG. 1847.
Echinolampas
depressus!
Mortonia
australis!

1851.

HAGENOW, 1851?

Infulaster. (Casts distributed.)

1851.

J. E. GRAY, Ann. Mag. Nat. H. 1851, *February.*

Spatangus
Reginae! = **Spatagus purpureus** MÜLL. 1776.
Eupatagus
similis! = **Eupatagus Valenciennesii** AG. 1847.
Lovenia
elongata!
subcarinata!
Echinocardium
australe!
zealandicum! = *Echinocardium* **australe** GRAY, 1851.
Breynia
Australasiae!
Desorii! = *Spatangus* **Australasiae** LEACH, 1815.

1851. GRAY (*continued*).

Meoma
grandis!
Faorina
chinensis!
antarotica! = **Tripylus cavernosus** PHIL. 1845.
australis!
cavernosa!
Tripylus
Philippii!
Desoria (**Gray**) non AGASS. nec COTTEAU.
australis!
Schizaster
ventricosus!
Jukesii! = *Schizaster* **ventricosus** GRAY, 1851.
Kleinia
luzonica!
Agassizia
subrotunda! = **Agassizia scrobiculata** VAL. 1846.
Leskia (**Gray**) non ROB. DES.
mirabilis!

1851.

R. T. MAITLAND, Fauni Belgi. Septen. 1851.

Echinus
Basteri MAITL. non GMEL. = *Echinus* **acutus** LAM. 1816.

1851.

TROSCHEL, Wieg. Archiv. 1851, I.

Tripylus
Hamaxitus
excavatus!
Atrapus
grandis! = **Faorina chinensis** GRAY, 1851.
Abatus
cavernosus!
australis!

1852.

FORBES, Mon. Echinod. Brit. Tert. 1852, p. 5.

Temnechinus.

1852.

GIRARD, Proc. Bost. Soc. N. H. 1852, p. 213, *April.*

Amphidetus
Kurtzii! = *Echinus* **cordatus** PENN. 1777.

1853.

MICHELIN, Rev. Mag. Zoöl. 1853, *January.*

Magnosia.

1853.

DESOR, Act. Soc. Hélv. d. Scien. Nat. 1853, p. 279.

Linthia MER.
Prenaster.

1853.

PETERS, Monatsber. Akad. Berlin, 1853, *August.*

Astropyga
dubia ! = **Cidarites pulvinata** LAM. 1816.
mossambica ! = **Cidaris radiata** LESKE, 1778.
Echinothrix
calamaris !
turcarum !
subularis !
spinosissima !
Desorii !
annellata ! = *Astropyga* **Desorii** AG. 1846.

1853.

D'ARCHIAC et HAIME, Anim. foss. de l'Inde, 1853, pp. 197–214.

Glyphocyphus.
Phymosoma.
Eurhodia.
Hardouinia.
Temnopleurus
depressus ! = **Cidaris toreumatica** KLEIN, 1734.
Eupatagus
pectoralis.

1853.

D'ORBIGNY, Pal. franç. Crét. VI. 1853, pp. 175–186.

Heteraster.
Ennalaster.
Epiaster.
Insufulaster (err. typ.) **Infulaster** HAG. 1851.

1854.

D'ORBIGNY, Rev. Mag. Zoöl. 1854, p. 16, *January.*

Echinanthus
orientalis
Richardii !
oviformis !
Echinobrissus
recens !
Echinodiscus
Augusti !

1854.

MICHELIN, Rev. Mag. Zoöl. 1854, p. 439, *August.*

Grasia.

1854.

DESOR, Synops. Échin. foss. 1854, pp. 39–48.

Rhabdocidaris.
Diplocidaris.
Porocidaris.
Leiocidaris
imperialis.

1854.

D'ORBIGNY, Pal. franç. Crét. VI. 1854, p. 269

Periaster
fragilis !
gibberulus !
cubensis !

1854.

MÜLLER, J., Bau. d. Echinod. 1854.

Heterocentrus
mammillatus.
trigonarius.
Colobocentrus
atratus.
Echinanthus
rangianus.
Clypeaster
tumidulus ! = *Echinus* **reticulatus** LIN. 1758.

1855.

PETERS, Denk. Akad. Berlin, für 1854.

Centrostephanus
longispinus !

1855.

J. E. GRAY, Catal. recent Echinida, Brit. Mus. 1855, *March.*

Echinanthus
scutiformis !
placunarius !
parvus.
Laganinum (err. typ.) **Laganum** KLEIN, 1734.
latissimum !
Laganum
Peronella
Peronii !
Arachnoides
zelandiae !
Rotula
Gualteri = Rotula Augusti KLEIN 1734.
Echinodiscus
truncata !
tenuissima !
Mellita
testudinea (err. typ.) **Mellita testudinata** KLEIN, 1734.
Echinoglycus
frondosus ! = *Echinodiscus* **emarginatus** LESKE, 1778.
grandis !
tetrapora
perspectiva !
cyclopora !
Stokesii !
Echinocardium
Mediterraneum
gibbosum !

1855. GRAY (*continued*).

Spatangus
Maretia.
planulata !
Plagionotus
Desorii !
Brissus
columbarius (err. typ.) **columbaris** LAM. 1816.
Metalia
sternalis !
Faorina
australis !
Schizaster
Nina
canalifera !
Jukesii !
ventricosa !
Brisaster
fragilis !
gibberulus !
cubensis !

1855.

J. E. GRAY, Proc. Zoöl. Soc. London, 1855, pp. 35–39, *March.*

Goniocidaris
pistillaris !
Hipponöe
sardica !
Holocentronotus (err. typ.) **Heterocentrotus** BRANDT.
Cidaris
ornata ! = *Cidarites* **annulifera** LAM. 1816.
annulata ! = *Cidarites* **annulifera** LAM. 1816.
spinulosa ! = *Cidarites* **tubaria** LAM. 1816.
Astropyga
depressa ! = *Cidarites* **pulvinata** LAM. 1816.
Garelia
aequalis ! = *Echinus* **calamaris** PALL. 1774.
clavata ! = *Astropyga* **Desorii** AGASS. 1846.
Toreumatica
Hardwickii !
granulosa ! = *Temnopleurus* **Reynaudi** AG. 1846.
Reevesii ! = " " " "
concava ! = *Salmacis* **Dussumieri** AG. 1846.

1855.

D'ORBIGNY, Pal. franç. Crét. VI. 1855, pp. 281–374.

Claviaster.
Faujasia.
Rhynchopygus
guadeloupensis.
Stigmatopygus.
Botriopygus.
Trematopygus.

1855.

DESOR, Synops. Échin. foss. 1855, pp. 61–130.

Hypodiadema.
Pseudodiadema.
Diademopsis.
Savignya *
subularis.
spinosissima.
calamaria.
Desorii.
Asteropyga (err. typ.) **Astropyga** GRAY, 1825.
Coptosoma.
Opechinus.
Codechinus.
Cottaldia.
Stomechinus.
Hypechinus.

1855.

WRIGHT, Brit. Oolitic Echin., 1855, p. 145.

Hemipedina.

1855.

MICHELIN, Rev. Mag. Zoöl. 1855, p. 245, *Mai.*

Moera (**Mich.**) non LEACH, 1813 nec HÜBN. 1816.
atropos
lachesis.
clotho!

1855.

COTTEAU, Échin. Yonne. I. 1855, p. 224.

Desoria (**Cott.**) non AGASS.

1855.

COTTEAU, Bull. Soc. Géol. France, XII., 1855, p. 710, *Mai.*

Desorella.

1856.

COTTEAU, Bull. Soc. Géol. France, XIII., 1856, p. 319, *February.*

Micropsis.
Cyclaster.

1856.

CONRAD, Pacif. R. R. Ex. Pal. VII. 1856, p. 196, *Pl. IX.*

Asterodaspis.
Scutella
striatula non M. de SERRES = *Scutella* **excentrica** ESCH. 1829.

1856.

COTTEAU, Échin. Sarthe, 1856, p. 417.

Galeropygus.

* No species mentioned, group specified.

1856.

DESOR, Synops. Échin. foss. 1856, pp. 131 – 155.

Stirechinus.
Phymechinus.
Diplophorus (err. typ.) **Diploporus** TROSCH. Ms.
Sphaerechinus
brevispinosus.
Loxechinus
albus.
Hyposalenia.
Eocidaris.

1856.

D'ORBIGNY, Pal. franç. Crét. VI. 1856, p. 418.

Clypeopygus.

1856.

MÜLLER, J., Echin. Eifel. Kalk. Berl. Ak. 1856, p. 356.

Lepidocentrus.

1856.

HUPÉ, in Castelnau Voyage Am. Sud. 1856.

Echinus
aciculatus! = *Echinus* **Gaimardi** BLAINV. 1825.
Heliocidaris
Castelnaudi! = *Echinus* **lucunter** LIN. 1758.
Echinoglycus
Valenciennesii.
oblongus.
subclausus.

1857.

BARRETT, Ann. Mag. Nat. Hist. XIX. 1857, p. 32, *January.*

Amphidotus
gibbosus (**Barrett**) non AG. = *Echinocardium* **pennatifidum** NORM. 1869.

1857.

STIMPSON, Crust. Ech. Pacif. Sh., Journ. Bost. Soc. N. H. 1857.

Echinus
chloroticus! non VAL. 1846 (err. typ.) *chlorocentrotus* BR.
purpuratus!

1857.

McCRADY, in Tuomey and Holmes Pliocene foss. So. Ca. pp. 4 – 10, 1857.

Psammechinus
exoletus = *Echinus variegatus* (**Lam.**) 1816, non LESKE.
Agassizia
porifera.
Amphidetus
amplifiorus = *Echinus* **cordatus** PENN. 1777.
orthonotus.
Brissus
spatiosus = *Spatangus* **ventricosus** LAM. 1816.
Plagionotus
Holmesii = *Echinus* **grandis** GMEL. 1788.
Ravenellianus = " " " "

1857.

GRUBE, Wieg. Archiv. I. 1857.

Brissus
panis ! = *Spatangus* **ventricosus** LAM. 1816.

1857.

D'ORBIGNY, Pal. franç. Crét. VI. 1857, p. 454.

Oolopygus.

1857.

DESOR, Synops. Échin. foss. 1857, pp. 167–338.

Pileus.
Galeopyyus (err. typ.) **Galeropygus** COTT. 1856.
Pachyclypus.
Sismondia.
Rumphia
rostrata.
Peronii.
Mortonia (**Des.**) non GRAY. 1851.
Stenonia
Offaster.

1857.

SALTER, Ann. Mag. N. H. 1857, p. 332, *November.*

Paleodiscus.

1857.

PHILIPPI, Wieg. Arch. I. 1857.

Echinus
magellanicus.
Arbacia
Schythei = *Echinocidaris* **Dufresnii** BLAINV. 1825.

1858.

COTTEAU, Rev. Mag. Zoöl. 1858, *Mai.*

Pseudopedina.

1858.

EBRAY, Bull. Soc. Géol. Franc. XV. 1858, p. 482.

Centropygus.

1858.

DESOR, Synops. Échin. foss. 1858, pp. 359–416.

Isaster.
Toxobrissus.
Hemipatagus.

1858.

QUENSTEDT, Der Jura, 1858, p. 644, *Pl. II.*

Polycidaris.
Leptocidaris.

1858.

MICHELIN, Rev. Mag. Zoöl. 1858, *August.*

Mellita
longifissa!

1859.

COTTEAU, Rev. Mag. Zoöl. 1859, pp. 14–22, *April.*

Asterocidaris.
Pseudosalenia.

1859.

MICHELIN, 1859.

Hebertia.*

1859.

BRONN, Die Kl. u. Ord. d. Thier-Reichs, 1859, p. 341.

Schizaster
cordatus.

1859.

COTTEAU, Échin. Sarthe, 1859, pp. 210, 429.

Anorthopygus.

1859.

MICHELIN, Rev. Mag. Zoöl. 1859, *September.*

Echinarachnius
asiaticus! = *Scutella* **Rumphii** BLAINV. 1827.
Australiae! = " " " "
undulatus! = " " " "
Polyaster non GRAY, 1840.
elegans! = *Lagana* **decagona** LESS. 1841.

1860.

COTTEAU, Bull. Soc. Géol. Franc. XVII. 1860, p. 378, *Mars.*

Heterocidaris.

1860.

ÉTALLON, Rayonn. du Jura Sup. de Montbéliard. 1860.

Pseudodesorella.

1860.

L. AGASSIZ, Proc. B. S. N. H. 1860, p. 262, *Mai.*

Pygorhynchus
sp.!

1860.

COTTEAU, Échin. Sarthe, 1860.

Echinocyphus.

* Know this from COTTEAU's quotation only.

1860.

MAYER, Faunula d. Mar. Sandst. 1860, p. 11, *August.*

Leiospatangus.

1860.

COTTEAU, Échin. Yonne, II. 1860, p. 83.

Phyllobrissus.

1860.

MEEK & WORTHEN, Proc. A. N. S. Phila. 1860, pp. 396, 472.

Melonechinus
Oligoporus.

1860.

HOLMES, Post Plio. foss. So. Ca. 1860, p. 5, *Pl. II. f. 2.*

Anapesus
carolinus! = *Echinus* **punctulatus** LAM. 1816.

1861.

THOMSON, Edinb. New Phil. Jour. 1861, *January.*

Echinocystites.

1861.

COTTEAU, Pal. franç. Crét. VII. 1861, p. 96, *July.*

Heterosalenia.

1861.

MICHELIN, Rev. Mag. Zoöl. 1861, *July.*

Lobophora
Deplanchei! = **Mellita laevis** KLEIN, 1734.
Clypeaster
Saisseti! = *Echinanthus* **humile** LESKE, 1778.

1861.

COTTEAU, Échin. Sarthe, 1861, p. 403.

Leiosoma.

1861.

HALL, Prel. Notice new sp. Crinoids, 1861, p. 18.

Lepidechinus.

1861.

SARS, Norges Echin. 1861, p. 96, *June.*

Tripylus
fragilis!

1862.

COTTEAU, Rev. Mag. Zoöl. 1862, p. 72, *Mai.*

Heterolampas.
Heterodiadema.
Orthocidaris non A. AG. 1863.

1862.

ÉTALLON, Études paléont. s. le terr. Jurass. Haut Jura; Suppl. 1862, pp. 4, 5.

Pseudocidaris.
Hemipygus.

1862.

DUJARDIN et HUPÉ, Zooph. Échinodermes, 1862.

Leiocidaris
hystrix !
papillata !
affinis !
Stokesi !
Thouarsii !
Danae !
Salmacis
Desmoulinsii (err. typ.) **Dussumieri** AGASS.
Melebosis (err. typ.) **Melobosis** GIR. 1850.
mirabilis.
Psammechinus
pulchellus !
pustulatus !
decoratus !
longispinus !
laganoides !
magellanicus !
aciculatus !
Sphaerechinus
esculentus !
gibbosus !
Toxopneustes
aequituberculatus !
Tripneustes
fasciatus !
angulosus !
Michelinia non KONINCK, 1842.
elegans !
Podophora
Mertensii
Brissopsis
excavatus !
Philippii !
Echinolampas
ovatus !

1862.

MICHELIN, in Maillard, notes s. Bourbon, Annéxe A. 1862.

Keraiaphorus
Maillardi !
Savignya
Frappieri ! = *Astropyga* **Desorii** AG. 1846.
Tripneustes
fuscus ! = *Cidaris* **sardica** LESKE, 1778.
zigzag ! = " " " "

1862. Michelin (*continued*).

Tiaropneustes
indianus !
Hemipatagus
Mascareignarum ! = *Spatangus* **planulatus** Lam. 1816.

1863.
Cotteau, Échin. foss. des Pyren. 1863.
Pedinopsis.
Brissopatagus.

1863.
Belval, Bull. Acad. Brux. XV. 1863, p. 419, *March.*
Ancope
Ghiesbrechtii = *Echinodiscus* **emarginatus** Leske, 1778.

1863.
Cotteau, Pal. Franç. Crét. VII. 1863, *April.*
Temnocidaris.

1863.
Cotteau, Échin. Sarthe, 1863, p. 399.
Orthopsis.

1863.
Cotteau, Rev. Mag. Zoöl. 1863, p. 77, *June.*
Microdiadema.

1863.
A. Agassiz, Bull. Mus. Comp. Zoöl. I. 1863, *August.*
Gymnocidaris
metularia !
minor ! = (*Cidarites* **metularia** Lam. 1816.
(*Orthocidaris* (**A. Ag.**) non Cott. 1862.
hystrix !
affinis !
papillata !
Temnocidaris (**A. Ag.**) non Cott. 1863.
canaliculata !
Prionocidaris
pistillaris !
Stephanocidaris
tuberis ! non Lam. = (*Cidarites* **bispinosa** Lam. 1816.
Chondrocidaris
gigantea !
Cidaris
subularis !
cincta ! = **Diadema turcarum** Schrsv. 1711.
turcarum !
Echinocidaris
aperta ! = *Echinus* **calamaris** Pall. 1774.
scutata ! = *Astropyga* **Desorii** Ag. 1863.

1863. A. AGASSIZ (*continued*).

Diadema
paucispinum ! = *Diadema setosa* (**Gray,**) 1825.
mexicanum !
globulosum ! = *Diadema setosa* (**Gray,**) 1825.
Echinocidaris
Davisii ! = *Echinus* **punctulatus** LAM. 1816.
incisa ! = *Echinus stellatus* BLAINV. 1825.
Echinostrephus
aciculatus ! = *Echinometra* **setosa** RUMPH. 1705.
Acrocladia
cuspidata ! = *Echinus* **trigonarius** LAM. 1816.
Podophora
Quoyi !
Echinometra
Van Brunti !
rupicola ! = *Echinometra* **Van Brunti** A. AG. 1863.
microtuberculata ! = *Echinus lucunter* (**Lam.**) non LINN.
viridis !
plana ! = *Echinometra* **viridis** A. AG. 1863.
Parasalenia
gratiosa !
Toxocidaris
Delalandi !
mexicana ! (**A. Ag.**) non AG.
franciscana !
Loxechinus
purpuratus !
Psammechinus
chloroticus !
Sphaerechinus
granularis !
Temnopleurus
Reevesii ! non GRAY = **Cidaris toreumatica** KLEIN, 1734.
Toreumatica
concava ! non GRAY = *Temnopleurus* **Reynaudi** AG. 1846.
Melobosis
rarispinus !
Lytechinus
carolinus ! = *Echinus variegatus* (**Lam.**) non LESKE.
variegatus !
atlanticus ! = " " " "
Hemiechinus GIR. MS.
Boletia
granulata !
rosea !
Tripneustes
depressus !
Hipponoe
violacea ! = *Cidaris* **sardica** LESKE, 1778.
nigricans ! = " " " "

1863. A AGASSIZ (*continued*).

Stolonoclypus AGASS.
placunarius!
prostratus!
rotundus!
Rhaphidoclypus
scutiformis!
microtuberculatus! = *Echinus* **reticulatus** LIN. 1758.
Rumphia
Lesueuri!
Pygorhynchus
pacificus! AGASS.
Kleinia
nigra! = **Meoma grandis** GRAY, 1851.
Rhyssobrissus
niger!
Xanthobrissus.
Garetti! = *Spatangus* **sternalis** LAM. 1816.

1863.

S. P. WOODWARD, Geologist, 1863, *September*.

Echinothuria.

1863.

A. AGASSIZ, Proc. Acad. Nat. Scien. Phila. 1863, *December*.

Phyllacanthus
fustigera! BARN. = *Cidarites* **imperialis** LAM. 1816.
Diadema
nudum! = *Diadema setosa* (**Gray**,) 1825.
Thrichodiadema
Rodgersii!
Colobocentrotus
Leskei! (err. typ.) *Mertensii*.
Echinometra
brunea! = *Echinus lucunter* (**Lam.**) non LINN.
Glyptocidaris
crenularis!
Toxocidaris
nuda!
crassispina! = *Echinus* **tuberculatus** LAM. 1816.
globulosa! = **Toxocidaris franciscana** A. AG. 1862.
depressa!
Psammechinus
intermedius! BARN.
pulcherrimus! BARN.
Toxopneustes
carnosus! BARN. = *Echinus* **Dröbachiensis** MÜLL. 1776.
Microcyphus
elegans! = **Toreumatica Hardwickii** GRAY, 1855.
Anthechinus
roseus! = *Microcyphus* **maculatus** AG. 1841.

1863. A. AGASSIZ (*continued*).

Temnotrema
sculpta! = **Toreumatica Hardwickii** GRAY, 1855.
Laganum
Putnami! BARN.
Scaphechinus! BARN.
mirabilis! BARN.
Lobophora
texta! = **Mellita laevis** KLEIN, 1734.
Maretia
alta!
Lovenia
triangularis! = *Spatangus* **subcarinatus** GRAY, 1845.
Echinocardium
Stimpsoni! = *Echinocardium* **australe** GRAY, 1851.

1863.

BELVAL, Bull. Acad. Brux. XVI. 1863, p. 198, *August.*

Lobophora
Dubusii = *Echinodiscus* **auritus** LESKE, 1778.
Agassizii = " " " "

1864.

LÜTKEN, Bid. til Kunds. om Echin. 1864.

Psilechinus
variegatus!
Meoma
ventricosa!
Echinocidaris
longispina! = *Echinus* **stellatus** BLAINV. 1825.
Clypeaster
Riisei! = **Stolonoclypus rotundus** A. AG. 1863.
Agassizia
ovulum! = **Agassizia scrobiculata** VAL. 1846.
Goniocidaris
tubaria!
Anthocidaris
homalostoma!
eurythrogramma!
Ellipsechinus
macrostomus!
Echinometra
Michelini! non DES.
arbacia! = **Parasalenia gratiosa** A. AG. 1863.
Psammechinus
verruculatus! = *Cidaris* **angulosa** LESKE, 1778.
Ravenellia
Chaetodiscus
scutella! = **Scaphechinus mirabilis** BARN. 1863.

1864. LÜTKEN (*continued*).

Rhynchopygus
caribaearum !
Sphaeriechinus (err. typ.) **Sphaerechinus** DES. 1856.
granularis
indianus !
Brissopsis
pulvinatus

1865.

CONRAD, T. A., Proc. Acad. N. S. Phila. 1865, p. 74.

Macrophora
Echinianthus (err. typ.) **Echinanthus** BREYN. 1732.
Echinocardium
orthonotus.

1865.

MARTENS, Monatsb. Ak. Berlin, 1865, *März*.

Scutella
japonica ! = **Scaphechinus mirabilis** BARN. 1863.
Nucleolites
epigonus !

1865.

BÖLSCHE, Wieg. Archiv. I. 1865, p. 324.

Echinothrix
cincta !
aequalis !
clavata !
Petersii ! = **Diadema turcarum** SCHYNV. 1711.
Astropyga
major = *Cidarites* **radiata** LESKE, 1778.

1865.

GRUBE, Jahres-Ber. d. Schles. Ges. 1865.

Platybrissus
Roemeri !

1866.

WORTHEN & MEEK, Paleontology, Geology of Illinois. Vol. II. 1866, p. 242.

Melonopsis.

1866.

COTTEAU, Pal. franç. VII. Terr. Crét. 1866, p. 760, Mai.

Leiocyphus

1866.

GRAY, Proc. Zoöl. Soc. London. 1866, p. 176, *Juni*.

Spatangus
Maretia
variegata ! = *Spatangus* **planulatus** LAM. 1816.

1866.

COTTEAU, Rev. Mag. Zoöl. 1866, *Juin, Juillet.*

Leiopedina.
Echinopedina.

1866.

VERRILL, Proc. Bost. Soc. N. H. 1866 p. 340, *July.*

Euryechinus
granulatus !
Dröbachiensis !
lividus
gibbus ! (err. typ.) *Echinus* **gibbosus** VAL. 1846.
Delalandii

1866.

MARTENS, Wieg. Archiv. XXXII. 1866.

Temnopleurus
japonicus ! = *Temnopleurus* **Hardwickii** GRAY, 1855.
Echinus
disjunctus ! = *Toxocidaris* **depressa** A. AG. 1863.
Boletia
radiata ! = *Psammechinus* **pulcherrimus** BARN. in A. AG. 1863.
polizonalis.
Toxocidaris
purpurea ! = *Echinus* **tuberculatus** LAM. 1816.
Cidaris
circinnata MS. Amsterd. Mus. = *Cidarites* **annulifera** LAM. 1816.
fustigera !
Diadema
calamare !
Salmacis
pyramidata !
conica ! = *Salmacis* **sulcatus** AG. 1846.
Clypeaster
testudinarius !
Nucleolus ! (err. typ.) **Nucleolites** LAM. 1801.
epigonus !

1866.

MARTENS, Verhl. d. K. K. Zool. Bot. Ges. Wien, 1866, p. 381.

Acrocladia
planissima ! = **Cidaris mammillata** KLEIN, 1734.

1866.

SCHULTZE, L., Echinod. d. Eifler Kalkes. Denk. schr. Wien. Akad., 1866.

Xenocidaris.

1867.

COTTEAU, Pal. franç. VII. Terr. Crét. 1867, p. 822, *January.*

Micropedina.

1867.

GRUBE, Jahresb. d. Schles. Ges. f. Vat. Cult. 1867, *April.*

Asthenosoma
varium !

1867. Grube (*continued*).

Salmacis
rubrotinctus ! — *Salmacis* **rarispinus** Ag. 1846.
festivus ! — " " " "

1867.
Verrill, Notes on Radiata, Trans. Conn. Acad. 1867; in Reprint, *June*.

Echinodiadema
coronata !
Astropyga
venusta ! — *Cidarites* **pulvinata** Lam. 1816.
Psammechinus
pictus ! — *Echinus* **semituberculatus** Val. 1847.
Lytechinus
roseus !
Boletia
viridis ! — *Echinus* **chloroticus** Val. 1846.
Euryechinus
imbecillis ! — *Echinus* **gibbosus** Val. 1846.
Toxopneustes
sp. ! — **Toxocidaris** *mexicana* (**A. Ag.**) 1863.
Encope
occidentalis ! — *Encope* **micropora** Ag. 1841.
Astriclypeus
Manni !
Mellita
pacifica !
Stolonielypeus (err. typ.) **Stolonoclypus** Ag. 1863.
rotundus !
Brissus
obesus !
Meoma
nigra !
Metalia
nobilis ! — *Echinus* **maculosus** Gmel. 1788.
Garetti !

1867.
Martens, Wieg. Arch. XXXIII. 1867, p. 112.

Encope
aberrans ! — *Encope* **Michelini** Ag. 1841.

1867.
Loven, Öfv. K. Vet. Akad. Förh. 1867.

Palaeostoma
mirabilis !

1868.
Norman, 4th Dredging Report Shetland Islands, Brit. Ass. Adv. Sci. 1868, p. 314.

Toxopneustes
pictus ! — *Echinus* **Dröbachiensis** Müll. 1776.

1868. NORMAN (*continued*).

Echinocardium
pennatifidum.
Spatangus
meridionalis! (**Norm.**) et auct. anglic. non RISSO = *Spatangus* **Raschi** LOVEN, 1869.

1868.
LAUBE, Echin. d. Vicentin. Tertiärgebiets, Akad. Wien. p. 13, 1868.

Chrysomelon.

1868.
TROSCHEL, Nieder Hess. Gesell. f. Nat. u. Heilkun. 1868, *July*.

Crustulum
gratulans! = **Astriclypeus Manni** VERRILL, 1867.

1868.
WORTHEN & MEEK, Geol. Pal. Illinois, III. 1868, p. 522.

Lepidesthes.

1868.
GRUBE, Monatsb. Berlin, Ak. 1868, *März*.

Anochanus
sinensis!

1869.
VERRILL, Proc. Bost. Soc. N. H. 1869, *April*.

Desoria
nodosa! = *Desoria* **australis** GRAY, 1851.

1869.
COTTEAU, Rev. Mag. Zoöl. 1869, *Mai*.

Echinodiadema (**Cott.**) non VERRILL, 1867.

1869.
LOVEN, Öfv. af. K. Vetensk. Ak. Förh. 1869.

Spatangus
Raschi!

1869.
THOMSON, Dredging Rept. Porcupine, Proc. R. S. 1869.

Calveria
hystrix!

1869.
TROSCHEL, Verhandl. N. H. V. Rhein. u. West. 1869, p. 96.

Pseudoboletia
maculata! = *Toxopneustes* **indianus** MICH. 1862.
stenostoma! = *Boletia* **granulata** A. AG. 1863.
Podophora
quadriseriata = Colobocentrotus Mertensii BR. 1835.

1869.

E. v. MARTENS, Decken's Reise in Ost. Africa, Seesterne u. Seeig. v. Sancibar, 1869.

Bryssus (err. typ.) **Brissus** KLEIN, 1734.
sternalis.
bicinctus.
carinatus.
compressus.

1869.

A. AGASSIZ, Prelim. Report Echini. Bull. M. C. Z. II. 1869, p. 9, *October.*

Cidaris
annulata ! non GRAY, = *Cidarites* **tribuloides** LAM. 1816.
Dorocidaris
abyssicola ! = *Cidaris* **papillata** LESKE, 1778.
hystrix !
papillata !
affinis !
Stokesii !
Salenocidaris
varispina !
Caenopedina
cubensis !
Podocidaris
sculpta !
Echinus
gracilis !
Flemingii ! non BALL. = *Echinus* **norvegicus** D. o. K. 1844.
Genocidaris
maculata !
Trigonocidaris
albida !
Stolonoclypus
Ravenellii !
Encope
Griesbachii (err. typ.) *Ghiesbrechtii.*
Echinolampas
caratomoides ! = *Echinolampas* **depressus** GRAY, 1851.
Rhyncholampas
caribbaearum !
pacificus !
Neolampas
rostellatus !
Pourtalesia
miranda !
Lissonotus (**A. Ag.**) non SCHÖN. 1817.
fragilis !
Agassizia
excentrica !
Echinocardium
laevigaster ! = *Echinocardium* **pennatifidum** NORM. 1868.
Kurtzii !

1869. A. AGASSIZ (*continued*).

Schizaster
cubensis ! non d'ORB. in AG. C. R. = *Brissus* **fragilis** D. o. K. 1844.
Diadema
mexicanum ! juv. non A. AG. = **Echinodiadema coronata** VERRILL. 1867.
Lytechinus
semituberculatus !
Plagionotus
nobilis !

1869.

PERRIER, Pédicell. Thèse Fac. Scienc. Paris, 1869.

Cidaris
rosaceus ! ROUSSEAU = *Cidarites* **annulifera** LAM. 1816.
Callao ! = *Cidaris* **Danae** AG. 1846.
Echinus
lezaroides ! (err. typ.) *laganoides* = *Echinus* **molaris** BLAINV.
Psammechinus
No. 248 ! = *Echinus variegatus* (**Lam.**) 1816, non LESKE.
Tripneustes
bicolor ! VAL. = *Cidaris* **sardica** KLEIN, 1734.
Echinometra
No. 274 ! = *Echinus* **purpuratus** STIMPS. 1857.
Acrocladia
violacea ! BLAINV. = *Echinus* **trigonarius** LAM. 1816.
serialis ! VAL. = **Cidaris mammillata** KLEIN, 1734.
Echinolampas
cyclostomus ! = **Scutum ovatum** KLEIN, 1734.
Hellei ! VAL. = *Echinolampas Richardi* (**Desml.**) 1837, non DESMT.
Brissopsis
parma ! VAL. = *Brissus* **lyrifer** FORBES, 1841.
No. 18 ! = " " " "
Breynia
nigra !
Amphidetus
Novae Zelandiae ! VAL. = *Echinocardium* **australe** GRAY, 1851.
No. 71 ! = *Echinus* **cordatus** PENN. 1777.
No. 193 ! = **Spatagus flavescens** MÜLL. 1774.
Gaimardi ! = ?
Lovenia
quadrimaculata ! VAL. = *Spatangus* **planulatus** LAM. 1816.

1869.

POMEL, Introduc. aux Échinodermes, 1869.

Trachypatagus.
Leiopatagus (err. typ.) **Leiospatangus** MEYER, 1860.
depressus.
hypsopatagus.

1869. POMEL (*continued*).

hemibrissus
ventricosus.
Schizobrissus.
peribrissus.
trachyaster.
paraster
gibberulus.
bolbaster.
hypsaster.
heteropneustes.
hypsoclypus.
clypeolampas.
Echinolampas
Bottae ! = **Scutum ovatum** KLEIN, 1734.
amphisalenia.
prodiadema.
glyphopneustes.
malebosis (err. typ.) **Melobosis** GIR. 1850.
micropsidia.
arbacina.
schizechinus
semituberculatus.
variegatus
excavatus.
oligophyma.
Olopneustes (err. typ.) **Holopneustes** AG. 1841.
MacCoya.
Wrightia (**Pomel**) non AGASS. 1862.

1870.

G. O. SARS, Nye Echin. Vid. Selsk. Forh. 1871.

Echinus
depressus non BLAINV.
Toxopneustes
pallidus = *Echinus* **Dröbachiensis** MÜLL. 1776.

1870.

VERRILL, Sill. Journ. 1870, p. 93, *January.*

Clypeaster
speciosus ! = *Echinanthus* **testudinarius** GRAY, 1851.
Encope
californica !

1870.

DESMOULINS, Act. Soc. Linn. Bordeaux, 1870.

Echinolampas
Rangii = *Echinolampas* **Hellei** VAL. in PERR. 1869.

1871.

VERRILL, Notes on Radiata, Trans. Conn. Acad. 1871, *February* and *March*.

Plagionotus
africanus!
Boletia
picta!
Evechinus
chloroticus!
Toxocidaris
homalostoma!
eurythrogramma!
Clypeaster
testudinarius! = *Echinanthus* **testudinarius** GRAY, 1851.

1871.

A. AGASSIZ, Bull. M. C. Z. No. 5, II. 1871, *April;* Suppl. to Bull. No. 9, I. 1869.

Coelopleurus
Maillardi!
sp.

1871.

COSTA, O. G., Monog. degli Echinocyami viv e foss.....1871.

Echinocyamus
parthenopaeus = Spatagus pusillus MÜLL. 1776.
speciosus = " " " "

1872.

A. AGASSIZ, Preliminary Notice of a few Echini, Bull. M. C. Z. III. No. 4, 1872, *January*.

Strongylocentrotus
armiger!
Sphaerechinus
Australiae!
Amblypneustes
pentagonus!
inflatus! LÜTK.
purpurescens! LÜTK.
Holopneustes
inflatus!
purpurescens!
Spatangus
Lütkeni!
Lovenia!
cordiformis! LÜTK.
Moera
stygia! LÜTK.
Rhynobrissus
pyramidalis!

SYNONYMY.

THIS second series of lists contains the Synonymy, which I look upon as the *history of the species* (not its Natural History). The synonymes quoted have all been taken from the originals unless otherwise marked (teste .....), giving the authority for their accuracy. The (!) therefore does not mean that I have verified the quotation, but that I have examined authentic specimens. The genera adopted in this revision, as well as the species in their respective genera, are arranged alphabetically. In the descriptive part of the text the references for the name adopted and for the original name alone are given; the notation is as follows: —

Temnopleurus toreumaticus
Cidaris toreumatica ! KLEIN, 1734, Nat. Disp. Ech.
Temnopleurus *toreumaticus* ! AGASS. 1841, Monog. Scut.

Amblypneustes griseus
Echinus **griseus** ! LAM. 1816, An. s. Vert.
Amblypneustes *griseus* ! AGASS. 1841, Monog. Scut.

the character of the type, of the original name, always showing the relations of the specific and generic names at the time the species was described, as in the Chronological List. Not to introduce too many doubtful synonymes, a general concordance of all the names given to Echini, including MS. names mentioned, is added, where doubtful synonymes will be found recorded by referring them to some species of this Revision; this may serve as a ready reference for all the known species. To supplement the Chronological, Synonymic, and Alphabetical Lists, I shall add a Systematic Index of the species, mentioned in this Revision, giving the original name and the principal localities. As it was found impossible to add to each citation a locality without introducing too much doubtful material, only accurate localities are quoted. For each species I have given a complete list of all the localities from which specimens are recorded, with their authorities, indicating at the same time by the usual mark (!) whenever I have seen the specimens mentioned. In the Geographical Lists the species found in any one locality will be so arranged as to show the faunal peculiarity of a region, while the exact range of each species is always carefully specified with its synonymy. (*) denotes that specimens are in the Coll. M. C. Z.

AGASSIZIA.

Agassizia VAL. 1846. Voyage Vénus.
Agassizia AGASS. 1847. Cat. Rais. Ann. Sc. Nat., VIII. p. 20.

Agassizia excentrica

Agassizia **excentrica** ! A. AGASS. 1869. Bull. M. C. Z., I. p. 276. Straits of Florida.
? *Brissopsis* **poriferus** RAV. 1848. Echin. So. Ca.
? *Agassizia porifera* MCCRADY, 1851. In Plioc. Foss. So. Ca., *Pl. I. f. 5.*

*Off Tortugas, 35, 36 fms. 45 fms. ! *Florida Gulf Stream ! (Pourtalès).

Agassizia scrobiculata

Agassizia scrobiculata ! VAL. 1846. Voyage Vénus, Zooph., *Pl. I. f. 2.* Peru.
Agassizia scrobiculata ! VAL. 1847. In Agass. C. R. Ann. Sc. Nat., VIII. p. 20.
" " GRAY, 1855. Cat. Recent Echini, p. 62.
" " ! DUJ. HUPÉ, 1862. Échin., p. 604.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 28. Panama.
" " ! PERRIER, 1869. Pédicell., p. 177.
Agassizia **subrotunda** ! GRAY, 1851. Ann. Mag. N. H., VII. p. 133.
" " ! " 1855. Cat. Rec. Ech., p. 63., *Pl. III. f. 2.* Australia?
" " ! VERRILL, 1870. Sill. Journ., XLIX. p. 95.
" " ! " 1869. Proc. Bost. S. N. H., p. 382.
" " ! " 1871. Notes on Radiata, p. 593.
Agassizia **ovulum** ! LÜTK. 1864. Bidrag..... p. 134, *Pl. II. f. 8.* Boccones.
" " ! VERRILL, 1867. Notes on Radiata, p 320. Panama.

*Panama (A. Agassiz, Jewett); *Peru (J. d. P.); Boccones ! (Mus. Cop); La Paz ! (Pedersen, Yale Coll.).

AMBLYPNEUSTES.

Echinus LAMK. 1816. A. s. V. (pars.)
Amblypneustes AGASS. 1841. Introd. Monog. Scut.
Amblypneustes AGASS. 1846. C. R. Ann. Sc. Nat., VII. p. 362.
Codechinus DES. 1855. Synops. Éch. foss.

Amblypneustes formosus

Amblypneustes **formosus** ! VAL. 1846. Voyage Vénus, Zooph., *Pl. II. f. 2.*
" *formosus* ! DUJ. HUPÉ, 1862. Échin., p. 518.
" **scalaris** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 362. New Holland.
" *scalaris* ! DUJ. HUPÉ, 1862. Échin., p. 518.

? Galapagos ! (J. d. P.); *Australia; Tasmania ! Adelaide ! (Brit. Mus.).

Amblypneustes griseus

Echinus **griseus** ! Blainv. 1825. Dict. S. N. Oursin, p. 81.
Echinus griseus ! Blainv. 1834. Actinol., p. 227.
" " ! Desml. 1837. Syn., p. 274.
Amblypneustes *griseus* ! Agass. 1841. Monog. Scut. Introd.
" " ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 362. Vanikoro.
Amblypneustes griseus ! Duj. Hupé, 1862. Échin., p. 518.

*Australia ! *New Zealand ! (Wright) ; Port Jackson ! (Mus. Stutt.) ; Vanikoro ! (J. d. P.) ; Adelaide ! Van Diemen's Land ! Port Philip ! Murray Riv. ! New Zealand ! (Brit. Mus.)

Amblypneustes ovum

Echinus **ovum** ! Lamk. 1816. An. s. Vert., p. 48. Australia ?
Echinus ovum ! Blainv. 1825. Dict. S. N. Oursin, p. 81.
" " ! Blainv. 1834. Actinol., p. 227.
" " Desml. 1837. Syn., p. 274.
Amblypneustes ovum Agass. 1841. Int. Anat. Ech., p. ix.
" " ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 362.
" " ! Duj. Hupé, 1862. Échin., p. 517.
" **textilis** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 362.
" *textilis* ! Duj. Hupé, 1862. Échin., p. 518.
" **serialis** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 362.
" *serialis* ! Duj. Hupé, 1862. Échin., p. 518.

*Australia ! *Hobart Town ! (Hamb'g Mus.) ; *Van Diemen's Land ! (B. M. Wright) ; Port Jackson ! (Mus. Stutt.) ; Port Lincoln ! Port Philip ! Tasmania ! (Brit. Mus.).

Amblypneustes pallidus

Echinus **pallidus** ! Lamk, 1816. An. s. Vert., p. 48.
" *pallidus* DesLong. 1824. Enc. Méth., II. p. 591.
" " ! Blainv. 1825. Dict. S. N. Oursin, p. 81.
" " ! Blainv. 1834. Actinol., p. 227.
" " Desml. 1837. Syn., p. 274.
" (*Amblypneustes*) *pallidus* ! Val. 1846. Voyage Vénus, Zooph., *Pl. II. f. 1.*
Amblypneustes pallidus ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 362 Australia.
" " ! Duj. Hupé, 1862. Échin., p. 518.

*M. C. Z. ; Port Jackson ! (Mus. Stutt.) ; Holdfast Bay ! Murray Riv. ! Port Philip ! Adelaide ! Feejee Islands ! (Brit. Mus.) ; Vanikoro ! (J. d. P.).

Amblypneustes pentagonus

Amblypneustes **pentagonus** ! A. Ag. 1872, Bull. M. C. Z., III. No. 5. Mauritius ?

*Mauritius (Brandt).

† (ECHINOBRISSUS.) Anochanus.

Anochanus Grube, 1868. Monatsb. d. Akad. Berlin, March, p. 178.

Anochanus sinensis

Anochanus sinensis ! Grube, 1868. Monatsb. d. Ak. Berlin, March, p. 178. China Seas.

East India Islands ! (Grube, Breslau Mus.).

† When a genus appears in parentheses its subgenera are denoted by smaller type, — Anochanus.

ARACHNOIDES.

Echinodiscus BREYN. 1732. Schedias. (pars.)
Arachnoides KLEIN, 1734. Nat. Disp. Ech.
Echinus LIN. 1758. Syst. Nat. (pars.)
Echinarachnius LESKE, 1778. KL. Add. (non GRAY, nec AGASS.)
Scutella LAMK. 1816. An. s. Vert. (pars.)
Echinodiscus BLAINV. 1830. Actinol. (pars.)
Arachnoides AGASS. 1841. Monog. Scut., p. 94.

Arachnoides placenta

..... RUMPH. 1705. Amb. Rar. Kam., *Pl. XIV. f.* G.
Echinodiscus *maximus* ..... BREYN. 1732. Schedias., p. 64, *Pl. VII. f. 7, 8.*
Arachnoides KLEIN, 1734. Nat. Disp. Ech., *Pl. XX. f.* A, B.
..... GUALTERI, 1742. Index Test., *Pl. CX. f.* G.
..... SEBA, 1758. Thes., III. *Pl. XV. f. 21, 22.*
Echinus **placenta** LINN. 1758. Syst. N., ed. X. p. 666.
" *placenta* GMEL. 1788. LINN. Syst., 3195.
Scutella " ! LAMK. 1816. An. s. Vert., p. 11. So. Pacific.
Scutella " ! BLAINV. 1827. Dict. S. N. Scut., p. 225.
" " DESML. 1837. Syn., p. 228.
Echinarachinus *placenta* ! LESKE, 1778. KL. Add., *Pl. XX. f.* A, B.
Echinarachnius placenta ! GRAY, 1825. Ann. Phil., p. 6.
" " FLEM. 1828. Brit. An., p. 479.
" " ! AGASS. 1836. Prod., p 188.
" " FORBES, 1841. Brit. Starf., p. 178. Shetland?
" " ! GRAY, 1848. Brit. Rad., p. 5.
Echinodiscus " ! BLAINV. 1834. Actinol., p 64, *Pl. VII. f. 7, 8.*
Arachnoides " ! AGASS. 1841. Mon. Scut., p. 94, *Pl. XXI. f. 35-42.*
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 134. Amboina, Salomon Isl.
" " MÜLL. 1854. Bau d. Ech., *Pl. IV. f. 6, 7.*
" " ! GRAY, 1855. Cat. Rec. Ech., p. 13. Australia.
" " BRONN. 1859. Kl. u. Or. Actin., *Pl. XXXIX. f. 2.*
" " DUJ. HUPÉ, 1862. Échin., p. 561.
Echinarachnius **Zelandiae** ! GRAY, 1845. Deiffb. Voy., II. p. 265. New Zealand.
Arachnoides Zelandiae ! GRAY, 1855. Cat. Rec. Ech., p. 14, *Pl. II. f. 2.*

*Auckland, *New Zealand (Edwards); *Port Mackay (Mus. Godef.); *Singapore (Novarra Ex.) *Cape York (Salmin); Amboina! Salomon Islands! (J. d. P.); Flinder's Island! Torres Straits! Cape Upstart! (Brit. Mus.); Burmah! (Boston N. H. Soc.); Philippine Islands! (Semper); Luzon! (Mus. Berl.); Timor, Buru, Borneo, New Holland (Martens).

ARBACIA.

Cidaris LESKE, 1778. KL. Addit. (pars.)
Echinus LAMK. 1816. An. s. Vert. (pars.)
Arbacia GRAY 1835. Proc. Zoöl. Soc. Lond., p. 58, April (non AGASS.).
Echinocidaris DESML. 1835. Tabl. Syn. July.
Agarites AGASS. 1841. Introd. Mon. Scut.
Tetrapygus AGASS. 1841. Introd. Mon. Scut.
Agarites AGASS. 1846. C. R. Ann. Sc. Nat., VI.
Tetrapygus AGASS. 1846. C. R. Ann. Sc. Nat., VI.

Arbacia Dufresnii

Echinus **Dufresnii** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 76.
" *Dufresnii* ! BLAINV. 1834. Actinol., p. 226.
Arbacia " ! GRAY, 1835. Proc. Zoöl. Soc. Lond., p. 38.
Echinocidaris Dufresnii DESML. 1837. Syn., p. 306.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353.
" " ! DUJ. HUPÉ, 1862. Échin., p. 520.
" " ! PERRIER, 1869. Pédicel., p. 144.
" " VERRILL, 1871. Notes on Radiata, p. 580.
Agarites " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353.
Echinocidaris **Schythei** PHIL. 1857. Wieg. Archiv, I. p. 13. So. Extrem. So. Am.
" *Schythei* DUJ. HUPÉ, 1862. Échin., p. 521.
" " PERRIER, 1869. Pédic., p. 145.

*So. Am. So. Extrem.; W. Coast Patagonia! Straits Magellan! (Brit. Mus.); Chili! (Écol. Min.); ??Madeira! (J. d. P.)

Arbacia nigra

Echinus niger **Mol.** 1782. Chili, p. 175 (non RUMPH). Chili.
Echinocidaris nigra ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354. Peru.
" " MÜLL. 1854. Bau d. Echin., *Pl. III. f. 1, 2.*
" " BRONN, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 19, 20.*
" " ! DUJ. HUPÉ. 1862. Échin., p. 521.
" " ! PERRIER, 1869. Pédic., p. 145.
" " DESML. 1871. Act. Soc. Linn. Bord., XXVII., *Pl. XI. f. 7, 8.*
Tetrapygus niger ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354.
Arbacia nigra ! A. AGASS. 1863. Bull. M. C. Z., I. p. 20.
" " ! VERRILL, 1867. Notes on Radiata, p. 301.
Echinocidaris pustulosa DESML. 1837. Syn., p. 304 (non AGASS.).
Echinus (*Agarites*) **purpurescens** ! VAL. 1846. Voyage Vénus, Zooph., *Pl. V. f. 1.* Peru.

*Coquimbo, Chili (D'Orbigny); *Mexillones, *Iquique (Dillingham, Putnam); *Valparaiso, *Callao (Edwards); *Caldera (Putnam); whole coast Chili (Philippi); Cape Horn! (Mus. Berl.); ? Philippine Islands! (Semper).

Arbacia punctulata

Echinus nodiformis ..... SEBA, 1758. Thes., III. *Pl. X. f. 10, a b?*
..... KNORR, 1771. Delic., *Pl. D. I. f. 9; Pl. D. III. f. 6.*
Echinus **punctulatus** ! LAMK. 1816. An. s. Vert., p. 47. Grandes Indes?
" *punctulatus* ! BLAINV. 1825. Dict. Sc. Nat. O., p. 75.
" " ! BLAINV. 1834. Actin., p. 226.
Arbacia *punctulata* ! GRAY, 1835. Proc. Zoöl. Soc. Lond., p. 58. (Not Phil. Mag., as says DESML.)
Arbacia " ! AGASS. 1836. Prod., p. 23.
Echinocidaris " DESML. 1837. Syn., p. 306.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353. W. Indies, So. Ca.
" " ! DUJ. HUPÉ, 1862. Échin., p. 520.
" " ! LÜTK. 1864. Bid., p. 97.
" " ! A. AGASS. 1869. Bull. M. C. Z., I. Straits Florida.
" " ! PERRIER, 1869. Pédic., p. 144.
" " DESML. 1871. Act. Soc. Linn. Bord. XXVII. *Pl. X. f. 1, 2.*
Agarites " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353.
Echinocidaris **Davisii** ! A. AGASS. 1863. Bull. M. C. Z., p. 20. Naushon.

*Naushon (A. Agassiz); *Newport (Wyman); *Cape Fear, 7 fms.; *Florida, off Tortugas, 13, 35, 36, 37, 44, 87, 125 fms.; *Sand Key, 20, 120 fms. (Pourtalès); Fort Monroe! Captiva Key, Fla.! (Smithson. Coll.); *Beaufort, N. C. (Bickmore); *Charleston, S. C. (Agassiz); *Charlotte Harbor (Maslin, Würdeman); *E. coast Fla. (Burkhardt); *Savannah, Ga. (Agassiz); *Indian Key (Würdeman); *Key West (Agassiz); *Hayti (Weinland).

Arbacia pustulosa

Cidaris *assulata pustulosa* KLEIN, 1734. Nat. Disp. Echin., *Pl. XI. f.* A, B.
Echinus **lixula** LINN. 1758. Syst. Nat.
" *Kermesinus* ..... SEBA, 1758. Thes., III. *Pl. X. f. 8, 15.*
..... KNORR, 1771. Delic., *Pl. D. f. 7.*
Cidaris **pustulosa** LESKE, 1778. KLEIN, Add., p. 85, *Pl. XI. f.* A, B.
Echinus pustulosus GMEL. 1788. LINN. Syst. Nat., 3179.
" " ! LAMK. 1816. A. s. V.
" " DESLONG. Enc. Méth., *Pl. CXLI. f. 6, 7.*
" " ! BLAINV. 1825. Dict. Sc. Nat. O., p. 75.
" " ! BLAINV. 1834. Actin., p. 226, *Pl. XX. f. 2.*
" " EDW. in CUV. Règ. An. Ed. Ill., *Pl. XIII. f. 3.*
Arbacia *pustulosa* ! GRAY, 1835. Proc. Zoöl. Soc. Lond., April.
Arbacia " ! AGASS. 1836. Prod., p. 23.
Echinocidaris pustulosa ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354 (non DESML.). Brazil.
" " ! DUJ. HUPÉ, 1862. Échin., p. 521.
" " ! PERRIER, 1869. Pédic., p. 144.
Tetrapygus " ! AGASS. 1846. C. R. Ann. Sc Nat., VI. p. 354.
Echinus **aequituberculatus** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 76.
" *aequituberculatus* ! BLAINV. 1834. Actin., p. 226.
Echinocidaris aequituberculata DESML. 1837. Syn., p. 306.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354, *Pl. XV. f. 3.* Palermo, Algeria.
" " ARADAS, 1853. Monog. Ech. Atti. Gioen. VIII. p. 87. Sicily.
" " MÜLL. 1854. Abhdl., VII. *Pl. II., III., IV.* (Pluteus).
" " SARS, 1857. Middelh. Litt. Faun., p. 110. Naples.
" " BRONN, 1859. Kl. u. Ord. Actin, p. 338.
" " ! DUJ. HUPÉ, 1862. Échin., p. 521.
" " ! DESML. 1871. Act. Soc. Linn. Bord., XXVII. *Pl. XI. f. 5, 6.*
Tetrapygus aequituberculatus ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354.
Arbacia equituberculata GRAY, 1835. Proc. Zoöl. Soc. Lond., p. 38.
Arbacia aequituberculata A. AGASS. 1863. Bull. M. C. Z., I. p. 20. Fayal.
Echinus **loculatus** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 75.
" *loculatus* ! BLAINV. 1834. Actin., p. 226.
Agarites loculatus AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353.
Echinocidaris loculata ! DESML. 1837. Syn., p. 306.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353. La Rochelle.
" " ! DUJ. HUPÉ, 1862. Échin., p. 521.
" " ! DESML. 1871. Act. Soc. Linn. Bord., XXVI. *Pl. X. f. 3, 4.*
Echinus **neapolitanus** DELLE CHIAJE 1825. An. senz. Vert.
" (*Agarites*) **grandinosus** ! VAL. 1846. Voyage Vénus, *Pl. XI. f. 1.*
Echinocidaris grandinosa ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354. Carthagena.
" " ! DUJ. HUPÉ, 1862. Échin., p. 521.
" " ! PERRIER, 1869. Pédic., p. 145, *Pl. IV. f. 7.*
Tetrapygus grandinosus ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 354.
Echinocidaris **sinensis** MICH. MS. (Coll. Cotteau).

*Palermo; *Naples (Panceri); *Fayal (Dabney, Higginson); *W. coast Italy (Rigacci); *Cape Verde Islands (Bouvier); *Liberia; *Cape Palmas (Perkins); W. coast-Africa! (J. d. P.); La Rochelle (imported, Desml.); Madeira! (Smithson. Coll.); Dalmatia (Müller); Lessina, Lissa, (Heller); *Desterro, Brazil, (Fritz Müller); *Rio Janeiro (Agassiz, Thayer Exp.); *Isla de Marecas, *Armaçao (Hartt, Thayer Exp.); Brazil! (J. d. P.).

Arbacia spatuligera

Echinus (*Agarites*) **spatuligera** ! VAL. 1846. Voyage Vénus, *Pl. V. f. 2.*
Echinocidaris spatuligera ! AGASS. 1846. Cat. R. Ann. Sc. Nat., VI. p. 353. Coquimbo.
" " ! DUJ. HUPÉ, 1862. Éch., p. 520.
" " ! VERRILL, 1867. Notes Radiata, p. 300. Peru.
" " ! PERRIER, 1869. Pédic., p. 144.
Agarites " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353.

*Callao (Edwards; Bradley, Yale Coll.); *W. coast S. Am. (J. d. P.); Paita! (Yale Coll.); Coquimbo! (J. d. P.); Guayaquil! (Mus. Cop.); whole coast Chili (Philippi).

Arbacia stellata

Echinus stellatus ! (**Blainv.**) 1825. Dict. Sc. Nat. O., p. 76 (non GMEL.)
" " ! BLAINV. 1834. Actin., p. 226.
Arbacia *stellata* ! GRAY, 1835. Proc. Zoöl. Soc. Lond., p. 38.
Echinocidaris stellata DESML. 1837. Syn., p. 306.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353. Galapagos.
" " ! DUJ. HUPÉ, 1862. Échin., p. 520.
" " ! VERRILL, 1867. Notes Radiata, p. 298. Peru, San Salvador.
" " ! PERRIER, 1869. Pédic., p. 144.
Agarites stellatus ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 353.
Echinocidaris **incisa** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 20. Panama, Guaymas.
" **longispina** ! LÜTK. 1864. Bid., p. 130, *Pl. I. f. 7.* Realejo.

*Panama (Sternberg, Edwards); *Sta. Barbara (Jewett); *Guaymas (Stone); *Margarita Bay, Califa (Essex Inst.); *Zorritos (Bradley, Yale Coll.); Galapagos! (J. d. P.); La Union! (Yale Coll.).

ASTHENOSOMA.

Asthenosoma GRUBE, 1867. Jahresb. d. Schles. Ges.
Calveria W. THOMS. 1869. Dredging Report Porcup. Exped., Proc. R. S.

Asthenosoma hystrix

Calveria hystrix ! W. THOMS. 1869. Dredging Report Porcupine. Atlantic, deep sea.
Calveria hystrix ! A. AGASS. 1871. Bull. M. C. Z., II. p. 457.

*Straits of Florida, 138 fms. (Pourtalès); *between Rockall and Rona, 547 fms. off Vigo, S. Cape Finistère (Porcupine Exped.).

Asthenosoma varium

Asthenosoma varium ! GRUBE, 1867. Jahresb. d. Schles. Ges., p.

China Seas! (Breslau Mus.).

(MELLITA.) ASTRICLYPEUS.

Astriclypeus VERRILL, 1867. Notes Radiata, p. 311.
Crustulum TROSCH. 1868. Bonn. Jubilaeun d. Fried. Wilh. Univ.

Astriclypeus Manni

Astriclypeus Manni ! VERRILL, 1867. Notes on Radiata, p. 311.
Astriclypeus Manni ! A. AGASS. 1869. Bull. M. C. Z. Japan.
Crustulum gratulans ! TROSCHEL, 1868. Bonn., *Pl. I.*
Crustulum gratulans ! TROSCHEL, 1869. Verhandl. N. H. Ver. Preuss. Rheinl., p. 96.
" " ! TROSCHEL, 1869. Wieg. Arch., I. p. 52. Japan.

*Linguin, China Seas (Liv'p'l Mus.); *Japan (Salmin); Yokohama! (Martens).

ASTROPYGA.

Cidaris LESKE, 1778. KL. Add. (pars.)
Echinus GMEL. 1788. LINN. Syst. N. (pars.)
Cidarites LAMK. 1816. An. s. V. (pars.)
Astropyga GRAY, 1825. Ann. Phil., p. 4.
Diadema DESML. 1837. Syn. (pars.)
Astropyga AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 345. (pars.)
" PETERS, 1855. Seeig. v. Mossamb., p. 112.

Astropyga pulvinata

Cidarites **pulvinata** ! LAMK. 1816. An. s. Vert., p. 59.
Diadema pulvinatum ! AGASS. 1836. Prod., p. 22.
" " DESML. 1837. Syn., p. 312.
Astropyga pulvinata ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 345.
" " ! BÖLSCHE, 1865. Wieg. Arch., I. p. 336.
" **dubia** ! PETERS, 1853. Monatsb. Berl. Ak., p. 484.
" *dubia* ! PETERS, 1855. Seeig. v. Mos., p. 114, *f. 2.*
" " ! BÖLSCHE, 1865. Wieg. Arch., I. p. 335.
" **depressa** ! GRAY, 1855. Proc. Zoöl. Soc. Lond., p. 38.
" *depressa* ! BÖLSCHE, 1865. Wieg. Arch , I. p. 336.
" " ! VERRILL, 1871. Notes Radiata, p. 579.
" **venusta** ! VERRILL, 1867. Notes Radiata, p. 296. Panama.

*San Salvador (Dow, Smithson. Coll.); *Panama (Bradley, Yale Coll.); La Paz ! (Yale Coll. Pedersen); Mazatlan ! (Mus. Stockholm, Copenh., Berlin, Hamburg).

Astropyga radiata

Echinanthus major ..... SEBA, 1758. Thes., III. *Pl. XIV. f. 1, 2.*
Cidaris **radiata** LESKE, 1778. KL. Ech., *Pl. XLIV. f. 1.* Copied from Seba in Enc. M., *Pl. CXL. f. 5, 6.*
" *radiata* BLAINV. 1834. Actin., p. 232, *Pl. XXbis f. 7.*
Echinus radiatus GMEL. 1788. LIN. Syst. Nat., 3174.
Cidarites radiata ! LAMK. 1816. An. s. Vert., p. 59. Asia.
Astropyga *radiata* ! GRAY, 1825. Ann. Phil., p. 2. ? S. Am.
Astropyga " ! AGASS. 1836. Prod., p. 22.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 345.
" " ! PETERS, 1855. Seeig. v. Mos., p. 112, *f.* 5, 6. Mozambique.
" " ! DUJ. HUPÉ, 1862. Échin., p. 506.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 18.
" " ! MARTENS, 1866. Wieg. Archiv, I. p. 158. Molucca, Amboina.
" " ! PERRIER, 1869. Pédic, p 137.
Diadema radiatum DESML. 1837. Syn., p. 312.
Astropyga **major** BÖLSCHE, 1865. Wieg. Arch., I. p. 335.
" **mossambica** ! PET. 1853. Monatsb. Berlin Ak., p. 484. Mozambique.
" *mossambica* ! PET. 1855. Seeig. v. Moss., p. 112, *f* 1.
" " ! BÖLSCHE, 1865. Wieg. Arch., I. p. 335.

*Zanzibar (Ropes, Essex Inst.); *Mauritius (Pike); Mozambique ! (Peters); Philippine Islands ! (Semper); Timor, Molucca (Martens); Borneo ! (Brit. Mus.).

BREYNIA.

Spatangus LEACH, 1815. Zoöl. Miscell.
Brissus AGASS. 1836. Prod. (pars.)
Breynia DES. 1847. AG. C. R. Ann. Sc. Nat., VIII. p. 12.

Breynia Australasiae

Spatangus **Australasiae** LEACH, 1815. Zoöl. Miscell., II. p. 68. Australia.
Breynia Australasiae ! GRAY, 1855. Cat. Rec. Ech., p. 46.
" " ! GRAY, 1851. Ann. Mag. N. H., VII. p. 131.
Spatangus **Crux Andreae** ! LAMK. 1816. An. s. Vert., p. 31. So. Pacific.
" *Crux Andreae* DESML. 1837. Syn., p. 378. Red Sea.
Breynia *Crux Andreae* ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 12, *Pl. XVI. f. 1.*
Breynia Crux Andreae ! DUJ. HUPÉ, 1862. Échin., p. 601.
" **Desorii** ! GRAY, 1851. Ann. Mag. N. H., VII. p. 131. Swan Riv.
" *Desorii* ! GRAY, 1855. Cat. R. Ech., p. 46.
" **Leachei** GRAY. MS. (Brit. Mus.).

*Australia, Port Jackson (U. S. Ex. Exp. Smithson. Coll.); *Australian Ocean; Hong Kong! (Vienna Mus.); Swan Riv.! W. Australia, King George's Sound! (Brit. Mus.); Red Sea, (Savigny); Hakodadi! (W. Stimpson, Smithson. Coll.).

(HEMIASTER.) BRISSOPSIS.

Brissopsis AGASS. 1840. Cat. Syst. Ectyp., p. 16.
Brissus FORBES, 1841. Brit. Starfish.
Brissopsis AGASS. 1846. C. R. Ann. Sc. N., VIII. p. 15.
Brissiopsis GRAY, 1848. Brit. Rad.
Kleinia GRAY, 1851. Ann. Mag. N. H., VII. p. 133 (non A. AGASS.).
Cyclaster COTT. 1856. Bull. Soc. Géol. fr. p. 319.
Toxobrissus DES. 1858. Synops. Éch. foss., p. 399.
Hemiaster DES. 1847. C. R. Ann. Sc. Nat., VIII.

Brissopsis luzonica

Kleinia luzonica ! GRAY, 1851. Ann. Mag. N. H., VII. p. 133. Philippine Islands.
Kleinia luzonica ! GRAY, 1855. Cat. R. Echin., p. 49, *Pl. IV. f. 5.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 599.

*Formosa (Mus. Godeff.); *Siam (Salmin); New Caledonia! (Crosse); Banca Straits! (Salmin); East India! (Mus. Godeff.); Luzon! (Brit. Mus.).

Brissopsis lyrifera

KNORR, 1771. Delic., *Pl. D II. f. 6, 7.*?
Brissus **lyrifer** ! FORBES, 1841. Brit. Starf., p. 187, fig. Isle of Man.
" *lyrifer* ! DÜBEN och KOREN, 1844. Skand. Echin., p. 280, *Pl. X. f. 46.* Norway.
Brissopsis lyrifera ! AGASS. DES. 1847. C. R. Ann. Sc. Nat., VIII. p. 15, *Pl. XVI. f. 12.*
" " MÜLL. 1854. Bau d. Echin., *Pl. III. f. 6, 7.*
" " BRONN, 1859. Kl. u. Ord. Actinoz., *Pl. XXXIX. f. 21; Pl. XLII. f. 6.*
" " ! SARS, 1861. Norges Ech., p. 96.
" " DUJ. HUPÉ, 1862. Échin., p. 597.
" " ! LÜTK. 1864. Bid., p. 181.

Brissopsis lyrifera (*continued*).

Brissopsis lyrifera ! A. AGASS. 1869. Bull. M. C. Z., p. 275.
" *lyrifer* ! PERRIER, 1869. Pédic., p. 173, *Pl. VII. f. 9.*
Brissiopsis *lyrifera* ! GRAY, 1848. Brit. Rad., p. 7.
Brissiopsis " GRAY, 1855. Cat. R. Echin., p. 55. Shetland.
Brissus **pulvinatus** PHIL. 1845 Wieg. Arch., I. p. 348. Sicily.
Schizaster **incertus** ARADAS, 1850. Monog. Ech. Atti. Gioen., VI. p. 91.
Brissopsis **parma** ! VAL. 1869. In PERR. Pédic., p. 178.

*Dröback (Eschricht); *Christianiafjord (G. O. Sars); *W. coast Norway, Bergen (Sars); *Great Britain; Greenland, Clyde (Forbes); Isle of Man (Gray); *off Valencia (Porcup. Exp.); *Mediterranean, Adventure Bk. (Porcup. Exp.); *W. coast Italy (Rigacci); *Mediterranean (Cotteau); Naples, Palermo (Philippi); *off Alligator Reef, 53, 79 fms., *off Marquesas, 55 fms., *Florida Gulf Stream, 55, 79, 128 fms., *Sombrero, 112 fms., *Tennessee Reef, 114 fms. (Pourtalès).

BRISSUS.

Brissus KLEIN, 1734. Nat. Disp. Echin.
Echinus GMEL. 1788. Syst. Nat. (pars.)
Spatangus LESKE, 1778. KL. Addit. (pars.)
Brissus AGASS. 1849. C. R. Ann. Sc. Nat., VIII.
Bryssus MART. 1869. Decken's Reise.

Brissus carinatus

..... SEBA, 1758. Thes., III. *Pl. XIV. f. 3, 4.*
..... E. M., *Pl. CXLVIII. f. 11.*
Spatangus ..... LESKE, 1778. KL. Ad., p. 249, *Pl. XLVIII. f. 4, 5.*
Spatangus **carinatus** ! LAMK. 1816. An. s. Vert., p. 30. Mauritius, So. Pacific.
" *carinatus* ! BLAINV. 1834. Actinol., p. 203.
" " DESML. 1837. Syn., p. 380.
Brissus " ! GRAY, 1825. Ann. Phil., p. 9.
" " ! AGASS. 1836. Prod., p. 185.
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 7.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 13.
" " ! GRAY, 1855. Cat. R. Echin., p. 53.
" " ! DUJ. HUPÉ, 1862. Echin., p. 605.
" " ! MART. 1866. Wieg. Arch., I. p. 181.

*Society Islands, *Sandwich Islands, *Kingsmills Islands (Garrett); *East Indies (Swift); *Bourbon (J. d. P.); *Mauritius (Pike); *Isle de France; Philippine Islands ! (Semper); Feejee Islands ! Pelew Islands ! (Mus. Godeff.).

Brissus obesus

Brissus **obesus** ! VERRILL, 1867. Notes Radiata, p. 316. Gulf Califa.
" *obesus* ! VERRILL, 1869. Proc. Boston Soc. N. H., p. 382.
" " ! VERRILL, 1871. Notes Radiata, p. 589. Cape St. Lucas.

*La Paz; *Panama (Jewett); Cape St. Lucas ! (Smithson. Coll.).

Brissus unicolor

Brissus unicolor ! KLEIN, 1734. Echin. ....., *Pl. XXVI. f. B, C.*
Brissus unicolor LESKE, 1778. KLEIN, Ad., *Pl. XXVI. f. B, C.*
Spatangus unicolor ! BLAINV. 1834. Actinol., p. 203.
" " ! DESML. 1837. Syn, p. 382.
..... SLOANE, 1725. Jam., *Pl. CCXLII. f. 3–5.*
..... SEBA, 1758. Thes, III. *Pl. X. f. 19, 19 a.* Copied, E. M., *Pl. CLVIII. f. 9 10.*
..... KNORR, 1771. Delic., *Pl. D. I. f. 13.*
Spatangus Brissus var. *ovatus* LESKE, 1778. KL., *Pl. XXXVIII. f. 4.* Copied from KNORR.
Echinus **ovatus** GMEL. 1788. LINN. Syst. Nat., 3199.
Spatangus ovatus LAMK. 1816. A. s. V. p. 30 (non LESKE).
" **columbaris** ! LAM. 1816. A. s. V., p. 30. Americ. Ocean.
" *columbaris* ! BLAINV. 1834. Actinol., p. 203.
" " DESML. 1837. Syn., p. 384.
Brissus columbaris ! GRAY, 1825. Ann. Phil., p. 9.
" " ! AGASS. 1836. Prod., p. 185.
" " ! AGASS. DES. 1847. C. R. Ann. Sc. Nat., VIII., p. 13. Cuba.
" " ! DUJ. HUPÉ, 1862. Échin., p. 605.
" " ! LÜTK. 1864. Bid., p. 118.
" **columbarius** ! GRAY, 1855. Cat. R. Echin., p. 54, *Pl. VI. f. 3.* West Indies.
" *carinatus* RISSO, 1826. Prod. Eur. Mér., V. p. 279 (non LAMK.).
" " ARADAS, 1853. Monog. Ech. Atti. Gioen., VI. p. 83.
" **Scillae** ! AGASS. 1836. Prod., p. 185.
" *Scillae* ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 13, *Pl. XVI. f.* 9. Mediterranean.
" " ! GRAY, 1855. Cat. R. Ech., p. 52.
" " ! BRONN, 1859. Klass. u. O. Actin., *Pl. XLII. f. 3.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 605, *Pl. IX. f. 7.*
" **placenta** PHIL. 1845. Wieg. Arch., I. p 349. Sicily.
" **dimidiatus** ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 13. Canary Islands.
" *dimidiatus* GRAY, 1855. Cat. R. Ech., p. 52.
" " ! DUJ. HUPÉ, 1862. Échin., p. 605.

*Tortugas, Fla. (Whitehurst); *Cape Florida (Würdeman); *Jeremie, Hayti (Weinland); *Bermudas; *Jamaica (Adams); *Gulf Stream, Fla., 128, 106, 80, 17 fms., *Sand Key (Pourtalès); Cuba! (Arango); Guadeloupe! (Mus. Copenh.); *Mediterranean; *Naples (Panceri); *W. coast Italy (Rigacci); *Canaries, Lazarote (Haeckel); *Cape Verde Islands (Bouvier); Palermo (Gray).

(DIADEMA.) CENTROSTEPHANUS.

Diadema PHIL. 1845. Wieg. Archiv, p. 354. (pars.)
Centrostephanus PET. 1855. Denk. Ak. Berlin, p. 109.
Thrichodiadema A. AGASS. 1863. Proc. A. N. S., Phila.
Echinodiadema VERRILL, 1867. Notes Radiata.

Centrostephanus coronatus

Echinodiadema coronata ! VERRILL, 1867. Notes Radiata, p. 294. Cape St. Lucas.
Echinodiadema coronata ! VERRILL, 1871. Notes Radiata, p. 580.
Diadema **mexicanum** ! A. AGASS. pars, 1869. Bull. M. C. Z., I. p. 282.
Thrichodiadema coronatum ! A. AGASS. MS.

Cape St. Lucas! (Xanthus, Smithson. Coll.).

Centrostephanus longispinus

Diadema **longispina** PHIL. 1845. Wieg. Arch., I. p. 354. Sicily.
" *longispina* BÖLSCHE, 1865. Wieg. Arch., I. p. 327.
Centrostephanus *longispinus* ! PET. 1854. Seeig. v. Moss., p. 109.
Diadema **europaeum** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 346. Palermo.
" *europaeum* ARADAS, 1853. Monog. Ech. Atti. Gioen., VIII. p. 168.
" " ! DUJ. HUPÉ, 1862. Échin., p. 505.

Palermo (Philippi); Canary Islands (Forbes); Madeira! (J. d. P.); Mediterranean! (Écol. Min.).

Centrostephanus Rodgersii

Thrichodiadema Rodgersii ! A. AGASS. 1863. Proc. A. N. S. Phila., p. 354. Port Jackson.
Thrichodiadema Rodgersii BÖLSCHE, 1865. Wieg. Arch., I. p. 336.

*Port Jackson (Stimpson)! *Houtman's Abrolhos (Liv'p'l Mus.); Bondy Head! Tasmania! (Brit. Mus.); New Caledonia! (Leipzig Mus.).

CIDARIS.

Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Cidarites LAM. 1816. An. s. Vert. (pars.)
Leiocidaris DUJ. HUPÉ, 1862. Échin. (pars.)
Cidaris AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Gymnocidaris A. AGASS. 1863. Bull. M. C. Z., I. p. 17.

Cidaris metularia

..... RUMPH, 1705. Amb. Rarit. Kam. *Pl. XIII. f. 4.*
Echinometra muscosa amboinensis SEBA, 1758. Thes., III. *Pl. XIII. f. 10, 11.* Copied in DESLONG. En. Méth., *Pl. CXXXIV. f. 8.*
..... LESKE, 1778. KL. Ad., *Pl. XXXIX. f. 4.*
Cidarites **metularia** ! LAMK. 1816. An. s. Vert., p. 56 (non LÜTK.). Isle de France.
" *metularia* DESML. 1837. Syn., p. 324.
Cidaris " ! BLAINV. 1830. Actin., p. 232.
" " ! AGASS. 1836. Prod., p. 21.
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 17.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 326. Seychelles, Salomon.
" " ! DUJ. HUPÉ, 1862. Échin., p. 470.
" " ! MART. 1866. Wieg. Arch., I. p. 142. Amboina, Red Sea.
" " ! PERRIER, 1869. Pédic, p. 125, *Pl. III. f. 2.*
Gymnocidaris *metularia* ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17. Zanzibar.
" **minor** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17. Sandwich Islands.

*Red Sea (J. d. P.); *Zanzibar (Cooke, Ropes, Webb); *Salomon Islands (J. d. P.): *Sandwich Islands, Kingsmills (Garrett); *Mauritius (Pike); Madagascar! Seychelles! Isle de France! (J. d. P.); So. China Sea, 40 fms.; Amboina (Martens); Philippine Islands! (Semper); Feejee Islands! (Mus. Godeff.); Cape Good Hope! (Brit. Mus.).

Cidaris Thouarsii

Cidaris **Thouarsii** ! VAL. 1846. AG. DES C. R. Ann. Sc. Nat., VI. p. 326. California, Galapagos.
" *Thouarsii* ! A. AGASS. 1863. Bull. M. C. Z, I. p. 17. Panama.
" " ! VERRILL, 1867. Notes Radiata, p. 294.
" " ! VERRILL, 1871. Notes Radiata, p. 579. La Paz.
Leiocidaris " ! DUJ. HUPÉ, 1862. Échin., p. 485.
" " ! PERRIER, 1869. Pédic., p. 130, *Pl. III. f. 8, 10.*

Cidaris Thouarsii (*continued*).

Cidaris **Danae**! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 326.
Leiocidaris Danae! DUJ. HUPÉ, 1862. Échin., p. 485. California.
Cidaris **Callao**! PERRIER, 1869. Pédic., p. 129. Callao.

*Guaymas (Capt. Stone); Gulf Calif.! (Mus. Copenh.); *Galapagos; *Panama (Adams, A. Agassiz, Jewett); *Cape St. Lucas, *Manzanillo! (Xanthus, Smithson. Coll.); Pearl Islands! (Bradley, Yale Coll.); La Paz! (Yale Coll.).

Cidaris tribuloides

..... SLOANE, 1725. Jam., *Pl. CCXLIV. f. 4–7.*
..... KNORR, 1771. Delic., *Pl. D. III. f. 5.* Copied in LESKE, *Pl. XXXVII. f. 3.*
Cidarites **tribuloides**! LAMK. 1816. An. s. Vert., p. 56. Indian Ocean.
" *tribuloides* DESML. 1837. Syn., p. 322.
" " DESLONG. 1824. E. M., *Pl. CXXXVI. f. 4, 5.*
Cidaris " ! BLAINV. 1830. Dict. S. Nat., p. 200.
" " ! AGASS. 1836. Prod., p. 21.
" " EDW. in CUV. Règ. An. Ed. Ill., *Pl. XII. f. 1, 2.*
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI., p. 326. Cuba.
" " MÜLL. 1854. Bau d. Ech., *Pl. II. f. 7.*
" " BRONN, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 1.*
" " ! DUJ. HUPÉ, 1862. Éch., p. 470.
" " ! STEWART, 1865. Trans. Lin. Soc., XXV., *Pl. XLVII. f. 5, 6*; *Pl. XLVIII. f. 3, 5, 11.*
" " ! MART. 1866. Wieg. Arch., I. p. 143.
" " ! PERRIER, 1869. Pédic., p. 126.
" *annulata*! A. AGASS. 1863. Bull. M. C. Z., p. 17 (non GRAY). Florida.
" " ! STEWART, 1870. Mic. Jour., XI. *Pl. IV.*
" *metularia*! LÜTK. 1864. Bid. p. 79 (non LAMK. nec AGASS.). W. Indies.

*Tortugas (Agassiz, Dr. Holder, Mills, Woodbury); *Hayti (Weinland, Uhler); *Florida Gulf Stream, 116 fms. (Pourtalès); *Cuba (Arango); *Tortugas, 36, 30 fms., *Cuba (Pourtalès); *Aspinwall (Bradley, Yale Coll.); *Gulf of Mexico; *Cape Palmas (Perkins, Essex Inst.); *Cape Verde Islands (Bouvier); Rio Janeiro! (Mus. Copenh.); So. Carolina! (Gibbes).

CLYPEASTER.

Echinanthus BREYN. 1732. Schedias. (pars.)
Scutum KLEIN, 1734. Nat. Disp. Echin. (pars.)
Echinus LIN. 1758. Syst. Nat. (pars.)
Echinodiscus LESKE, 1778. KL. Addit. (pars.)
Scutella LAMK. 1816. An. s. Vert. (pars.)
Clypeaster LAMK. 1816. An. s. Vert. (pars.)
Echinanthus GRAY, 1825. Ann. Phil. (pars.)
Lagana GRAY, 1825. Ann. Phil. (pars.)
Echinarachnius AGASS. 1836. Prod. (pars.)
Laganum DES. 1857. Syn. Éch. foss. (pars.)
Clypeaster MÜLL. 1854. Bau d. Echin.
Laganinum GRAY, 1855. Cat. R. Echin.
Stolonoclypus AGASS. 1863. Bull. M. C. Z.
Raphidoclypus A. AGASS. 1863. Bull. M. C. Z.
Stoloniclypeus VERRILL, 1867. Notes Radiata.

Clypeaster humilis

..... Rumphii, 1705. Rarit. Kam., *Pl. XIV. f. C.*
..... Seba, 1758. Thes., III. *Pl. XV. f. 13, 14.*
Scutum *angulare humile* ! Klein, 1734. *Pl. XIX. f. A, B.*
Echinanthus **humile** Leske, 1778. Kl. Add., *Pl. XIX. f. A, B.*
Echinus **rosaceus** Linn. 1758. Syst. Nat. X. p. 665. (pars.)
" *rosaceus* Gmel. 1788. Lin. Syst. N., 3186. (pars.)
Scutella placunaria ! Lamk. 1816. An. s. Vert., p. 12. Australian Ocean.
Scutella placunaria Desml. 1837. Syn., p. 228.
Echinodiscus placunarius ! Blainv. 1834. Actinol., p. 218.
Echinarachnius placunarius ! Agass. 1837. Prod., p. 188.
Clypeaster placunarius ! Agass. Des. 1847. C. R. Ann. Sc. Nat., VII. p. 130. Red Sea.
" " Müll. 1854. Bau d. Echin., *Pl. III. f. 8–14; Pl. IV. f. 8.*
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 3, 11, 12, 23, 25.*
" " Mich. 1861. Clyp., *Pl. XIV. f. 1.*
" " ! Duj. Hupé, 1862. Échin., p. 571.
Echinanthus " ! Gray, 1855. Cat. R. Ech., p. 7. Muscat.
Scutella ambigena ! Lamk. 1816. An. s. Vert., p. 12.
Scutella ambigena ! Blainv. 1827. Art. Scut. D. S. N., p. 229.
" " Desml. 1837. Syn., p. 228.
Echinanthus ambigena ! Gray, 1825. Ann. Phil., p. 5.
Clypeaster ambigenus ! Blainv. 1834. Actin., p. 216.
" " Desml. 1837. Syn., p. 214.
Scutella latissima ! Lamk. 1816. An. s. Vert., p. 12. Ocean Austral.?
Scutella latissima Desml. 1837. Syn., p. 228.
Echinodiscus latissimus ! Blainv. 1834. Actinol., p. 218.
Echinarachnius latissimus ! Agass. 1836. Prod., p. 188.
Laganum latissimum ! Agass. Des. 1847. C. R. Ann. Sc. Nat., VIII. p. 27.
? " " Hupé, 1856. In Casteln. Voy., p. 1, Zooph.
Laganinum *latissimum* ! Gray, 1855. Cat. R. Ech., p. 11.
Clypeaster **Rumphii** Desml. 1837. Syn., p. 216.
Echinanthus **explanatus** ! Gray, 1851. Proc. Zoöl. Soc. Lond., p. 35. Mauritius.
" *explanatus* ! Gray, 1855. Cat. R. Ech., p. 7, *Pl. II. f. 1.*
? " **productus** ! Gray, 1851. Proc. Zoöl. Soc. Lond., p. 35.
? " *productus* ! Gray, 1855. Cat. R. Ech., p. 6, *Pl. VI. f. 4.*
Clypeaster **Saissetî** ! Mich. 1861. Rev. Mag. Zoöl, p. 328, *Pl. IX. f. 2.* New Caledonia.

*Red Sea (J. d. P.); *Indian Ocean; *Calcutta (Theobald); Ceylon! (Humbert, Loriol.); Timor, (Martens); Muscat! (Brit. Mus.); New Caledonia! (Écol. Min.); Philippine Islands! (Semper).

Clypeaster rotundus

Stolonoclypus rotundus ! A. Agass. 1863. Bull. M. C. Z., I. p. 25. Acapulco.
Stoloniclypeus *rotundus* ! Verrill, 1867. Notes Radiata, p. 314. Panama.
Clypeaster **Riisei** ! Lütk. 1864. Bid., p. 132. Panama.

*Acapulco (A. Agassiz); *Panama! (Bradley, Yale Coll.); *Cape St. Lucas (Xanthus, Smithson. Coll.); San Diego.

Clypeaster scutiformis

Echinus **reticulatus** Linn. 1758. Syst. Nat., X. p. 666. (pars.)
Echinus reticulatus Gmel. 1788. Linn. Syst. Nat., 3191. (pars.)
Echinodiscus reticulatus Leske, 1778. Kl. Addit., p. 143, *Pl. XLV. f. 8, 9*, copied from Guet. [teri, *Pl. CX. f. D.*
Scutella reticulata Blainv. 1827. Art. Scut. D. S. N., p. 228.
Clypeaster reticulatus Desml. 1837. Syn., p. 214.
" " ! Mart. 1866. Wieg. Archiv., I. p. 171.
Echinus planus scutiformis Seba, 1758. Thes., III. *Pl. XV. f. 23, 24*, copied in E. M., *Pl.* [*CXLVII. f. 3, 4.*
" **scutiformis** Gmel. 1788. Linn. Syst. Nat.
Clypeaster scutiformis ! Lamk. 1816. An. s. Vert., p. 14. Indian Ocean?
" " ! Blainv. 1834. Actinol., p. 216.
" " ! Agass. 1836. Prod., p. 187.
" " ! Agass. Des. 1847. C. R. Ann. Sc. Nat., VII. p. 130. Persian Gulf.
" " ! Mich. 1861. Clyp. Monog., *Pl. XVIII. f. 1.*
Lagana *scutiformis* ! Gray, 1825. Ann. Phil., p. 6.
Echinanthus scutiformis Gray, 1855. Cat. R. Ech., p. 5. Red Sea.
Laganum scutiforme Desor, 1857. Synop. Echin., p. 228.
" " Duj. Hupé, 1862. Échin., p. 559.
Rhaphidoclypus *scutiformis* A. Agass. 1863. Bull. M. C. Z., p. 25.
Scutella **clypeastriformis** Blainv. 1827. Art. Scut. Dict. S. N., p. 228.
" *clypeastriformis* Desml. 1837. Syn., p. 230.
Lagana **ovalis** Blainv. 1834. Actinol., p. 215.
Scutella ovalis Agass. 1836. Prod., p. 188.
Echinanthus **Coleae** ! Gray, 1851. Proc. Zoöl. Soc. Lond., p. 35. Mauritius.
" *Coleae* ! Gray, 1855. Cat. R. Ech., p. 6, *Pl. II. f. 3.*
" **oblongus** ! Gray, 1851. Proc. Zoöl. Soc. Lond., p. 35. Philippines.
" *oblongus* ! Gray, 1855. Cat. R. Ech., p. 6, *Pl. I. f. 3.*
Rhaphidoclypus microtuberculatus ! A. Agass. 1863. Bull. M. C. Z., p. 25. Kingsmills Islands.

*Red Sea; *Bourbon (J. d. P.); *Krusenstern Island; *Kingsmills Islands (Garrett); Persian Gulf! Siguigor, Philippine Islands! (Brit. Mus.); Formosa! (Mus. Godeff.); Timor, Flores (Martens).

Clypeaster subdepressus

Scutum *angulare humile* ! Klein, 1734. *Pl. XIX. f. C, D.*
Echinanthus **subdepressus** ! Gray, 1825. Ann. Phil., p. 5.
" *subdepressus* ! Gray, 1855. Cat. R. Echin., p. 7. E. (W.) coast Africa.
Clypeaster " ! Agass. 1836. Prod., p. 187.
" **Rangianus** Desml. 1835. Étud. s. Échin., p. 62, *Pl. I.* W. coast Africa.
" *Rangianus* Desml. 1837. Syn., p. 214.
" " Agass. Des. 1847. Ann. Sc. Nat., VII. p. 130.
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 13, 18.*
" " Duj. Hupé, 1862. Échin., p. 571.
Echinanthus " Müll. 1854. Bau d. Echin., *Pl. IV. f. 2; Pl. V. f. 1–4.*
Scutella gibbosa ! (Rav.) 1845. J. A. N. S. Phila., p. 253 (non Risso nec Serres).
Clypeaster **prostratus** ! Rav. 1848. Cat. Ech. So Ca. So. Carolina.
" *prostratus* ! Lütk. 1864. Bid., p. 102, *Pl. II. f. 2.* W. Indies.
Stolonoclypus *prostratus* ! A. Agass. 1863. Bull. M. C. Z., I. p. 125. Florida.
Stolonoclypus " ! A. Agass. 1869. Bull. M. C. Z., I. p. 2.
" **Ravenellii** ! A. Agass. 1869. Bull. M. C. Z., 265. Straits of Florida.
Laganum latissimum ! Hupé, 1856. Casteln., Voyage Am. Sud, p. 98 (non Lam.). Brazil.
Clypeaster ambigena ! Mich. 1861. Clypeast. foss. Mém. Soc. géol. Fr., *Pl. XV. f. 1* (non Lam.).
" **guadeloupensis** ! Mich. MS. (Écol. Min.) Guadeloupe.

*Tortugas (Agassiz); *Charleston, S. C. (Gibbes); Cuba! (Arango); *Carysfort Reef, 40 fms., *Florida Reef, *S. of Rebecca Shoal, 11, 15 fms., Gulf Stream, Fla., 34 fms. (Pourtalès); *Georgia (Liv'p'l Mus.); Isle des Princes! (J. d. P.); W. coast Africa! (Brit. Mus.); Brazil! (Casteln.).

COELOPLEURUS.

Coelopleurus AGASS. 1840. Cat. Syst. Ectyp.
Coelopleurus AGASS. 1846 C. R. Ann. Sc. Nat., VI.
Keraiaphorus MICH. 1862. MAILLARD, Bourbon. Ann. A.
Coelopleurus A. AGASS. 1871. Bull. M. C. Z., II.

Coelopleurus floridanus

Coelopleurus sp. ! A. AGASS. 1871. Bull. M. C. Z., II. p. 456. Straits of Florida.

*Off Tennessee Reef, 160 fms. (Pourtalès).

Coelopleurus Maillardi

Keraiaphorus Maillardi MICH. 1862. MAILLARD, Bourbon Annéx. A., p. 2, *Pl. XIV.* Bourbon.
Coelopleurus Maillardi A. AGASS. 1871. Bull. M. C. Z., II. p. 456.

Bourbon! (Écol. Min. Maillard).

COLOBOCENTROTUS.

Echinus LINN. 1758. Syst. Nat. (pars.)
Cidaris LESKE, 1778. KLEIN, Addit. (pars.)
Echinometra GRAY, 1825. Ann. Phil. (pars.)
Colobocentrotus BRANDT, 1835. Prod., p. 266.
Echinometra DESML. 1837. Syn, p. 268. (pars.)
Colobocentrus GRAY, 1840. Syn. Brit. Mus.
Podophora AGASS. 1840. Cat. Syst. Ectyp.
Colobocentrotus A. AGASS. 1863. Proc. A. N. S. Phila., p. 354.
Podophora AGASS. 1846. C. R. Ann. Sc. Nat., VI.

Colobocentrotus atratus

Echinus **atratus** LINN. 1758. Syst. Nat., ed. X. p. 665.
" *atratus* GMEL. 1788. LINN. Syst. Nat., 3177.
" " ! BLAINV. 1825. Dict. Sc. Nat. O., p. 96.
Echinometra atrata ! GRAY, 1825. Ann. Phil., p. 5.
" " ! BLAINV. 1834. Actin., p. 225, *Pl. XX. f. 1.*
" " ! AGASS. 1836. Prod., p. 22.
" " DESML. 1837. Syn., p. 262.
" " EDW. in CUV. Règ. An. Ed. Ill, *Pl. XIII. f. 1.*
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 11. Isle de France.
Colobocentrotus *atratus* BRANDT, 1835. Prod., p. 267.
Podophora *atrata* ! AGASS. 1840. Cat. Syst. Ectyp.
Podophora " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 374. Seychelles Islands.
" " ! DUJ. HUPÉ, 1862. Échin., p. 541.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 21. Mauritius.
" " ! STEWART, 1865. Trans. Linn. Soc., XXV. *Pl. II. f. 7.*
" " ! MART. 1866. Wieg. Arch., I. p. 168. Java, Molucca.
" " ! PERRIER, 1869. Pédic., p. 165, *Pl. VI. f. 8a.*
Colobocentrus atratus MÜLL. 1854. Bau d. Ech., p. 8.
Cidaris **violacea** LESKE, 1778. KL. Add., p. 53, *Pl. XLVII. f. 1, 2*; copied in Enc. Méth., *Pl. CXL. f. 1–4.*

Colobocentrotus atratus (*continued*).

Echinus **Quoy** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 96.
Echinometra Quoyii ! BLAINV. 1834. Actin., p. 225.
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn., p. 262.
" " ! DUJ. HUPÉ, 1862. Échin., p. 539.
Colobocentrotus *Quoyi* BRANDT, 1835. Prod., p. 267.
Podophora " ! A. AGASS. 1863. Bull. M. C. Z., I. Sandwich Islands.
Echinus **pedifer** ! BLAINV. 1825. Dict. Sc. N. O., p. 97. Oahu.
Echinometra pedifera ! BLAINV. 1834. Actin., p. 225.
" " ! AGASS. 1836. Prod., p. 23.
" " ! DESML. 1837. Syn., p. 264.
Colobocentrotus *pedifer* BRANDT, 1835. Prod., p. 267.
Podophora pedifera ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 370. ? Valparaiso.
" " ! DUJ. HUPÉ, 1862. Échin., p. 541.
Colobocentrotus Leskei BRANDT, 1835. Prod., p. 266 (non A. AGASS.).

*Zanzibar; *Seychelles Islands; *Mauritius (Pike); *Sandwich Islands (Garrett); Java, Moluccas (Martens); *Callao? Valparaiso? (U. S. Ex. Exp., Smithson. Coll.).

Colobocentrotus Mertensii

Colobocentrotus Mertensii BRANDT, 1835. Prod., p. 266. Bonin Islands.
Colobocentrotus Mertensii DUJ. HUPÉ, 1862. Échin., p. 541.
Echinometra " DESML. 1837. Syn., p. 268.
Colobocentrotus Leskei ! A. AGASS. 1863. Proc. A. N. S. Phila., p. 354 (non BRANDT). Bonin Is.
Podophora **quadriseriata** TROSCHEL, 1869. Verhdl. d. Vaterländ, Cult. d. Rheinpf., p. 96.

*Bonin Islands (W. Stimpson, Smithson. Coll.); Australia (Troschel).

DIADEMA.

Diadema SCHYNV. 1711 (non SCHUM. 1817).
Cidarites LAMK. 1816. An. s. Vert. (pars.)
Diadema GRAY, 1825. Ann. Phil.
Cidaris BLAINV. 1834. Actin. (pars.)
Diadema AGASS. 1846. C. R. Ann. Sc. Nat., VI.
" PETERS, 1855. Denk. Ak. Berlin.
" BÖLSCHE, 1865. Wieg. Arch., I.

Diadema mexicanum

Diadema **mexicanum** ! A. AGASS. 1863. Bull. M. C. Z., p. 19. Acapulco.
" *mexicanum* ! BÖLSCHE, 1865. Wieg. Arch., I. p. 328.
" *mexicana* ! VERRILL, 1867. Notes Radiata, p. 294. Cape St. Lucas.

*Acapulco (A. Agassiz); *Cape St. Lucas (Xanthus, Smithson. Coll.).

Diadema setosum

..... SLOANE, 1725. Jam., *Pl. CCXLIII.*
..... KNORR, 1771. Delic, *Pl. DIII. f. 1, 2*, copied in LESKE, 1778, *Pl. XXXVII. f. 1, 2.*
Cidarites diadema ! (Lam.) 1816. An. s. Vert., p. 58 (non LIN.).
" " SAY, 1825. Journ. Ac. N. S. Phila., p. 225. Florida.
Cidaris " BLAINV. 1834. Actin., p. 231, *Pl. XXbis f. 6.*

Diadema setosum (*continued*).

Diadema turcarum DESML 1837. Syn., p. 308. (pars.)
" " ! MICH. 1845. Rev. Mag. Z., p. 15. (pars.) Isle de France.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 350. W. Indies.
" " ! DUJ. HUPÉ, 1862. Échin., p. 310.
" " PERRIER, 1869. Pédic, p. 135, *Pl. IV. f. 2c.*
" ***setosa*** ! (Gray,) 1825. Ann. Phil., p. 4 (non RUMPH.).
" ***setosum*** DESML. 1837. Syn., p. 310.
" ***setosa*** ! PETERS, 1854. Seeig. v. Moss., p. 109. Mozambique.
" " BÖLSCHE, 1865. Wieg. Arch., I. p. 325. W. Indies.
" **Savignyi** ! MICH. 1845. Rev. Mag. Z., p. 15. Isle de France.
" *Savignyi* ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 349. Red Sea, Bombay, Seychelles, Madagascar.
" " ! DESOR, 1854. Synops. Ech. foss., *Pl. XIII. f. 3.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 505.
" " BÖLSCHE, 1865. Wieg. Arch., I. p. 327.
" " ! MART. 1866. Wieg. Arch., I. p. 155.
" " PERRIER, 1869. Pédic., p. 135, *Pl. IV. f. 2b.*
" **antillarum** PHIL. 1845. Wieg. Arch., I. p. 355. Cuba.
" *antillarum* ! A. AGASS. 1863. Bull. M. C. Z., I. p. 19. Florida.
" " ! LÜTK. 1864. Bid., p. 83.
" **tenuispina** PHIL. 1845. Wieg. Arch., I. p. 354. Sicily.
" *tenuispina* BÖLSCHE, 1865. Wieg. Arch, I. p. 325.
" **Lamarckii** ! ROUSSEAU, 1846. AG. DES., C. R. Ann. Sc. Nat., VI. p. 350. Zanzibar.
" *Lamarckii* BÖLSCHE, 1865. Wieg. Arch., I. p. 327.
" **paucispinum** ! A. AGASS. 1863. Bull. M. C. Z., I. p 19. Sandwich Islands.
" *paucispinum* BÖLSCHE, 1865. Wieg. Arch., I. p. 328.
" **globulosum** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 20. Kingsmills, Society Islands.
" *globulosum* BÖLSCHE, 1865. Wieg. Arch., I. p. 328.
" **nudum** A. AGASS. 1863. Proc. A. N. S. Phila., p. 353. Hong Kong.
" *nudum* BÖLSCHE, 1865. Wieg. Arch., p. 328.
" STEWART, 1865. Trans. Lin. Soc., XXV. *Pl. XLIII. f. 18a.*
" Enc. Méth., *Pl. CXXXIII. f. 10.*
" **pseudosavignyi** MICH. MS. (Écol. Min.).
Calmarius annellata GRAY, MS. (Brit. Mus.).

*Tortugas (Agassiz, Woodbury); *off Tortugas, 17 fms. (Pourtalès); *Cape Florida, (Wurdemann); *Cienfuegos (Aviles); Matanzas (Philippi); *Cuba (Arango); *Jeremie, Hayti (Weinland); *Salt Key, Florida (Pourtalès); *Bahamas (Dr. Bryant); *off Bahamas, Santarem Chan., 40 fms. (Pourtalès); *Bermudas; Martinique! (J. d. P.); Aspinwall! (Smithson. Coll.); Surinam! (Mus. Copenh.); Madeira! (Stimpson, Smithson. Coll.); *Lanzerote, Canary Islands (Haeckel); Cape Verde Islands! (Bouvier, J. d. P.); *Red Sea; *Tor, Red Sea (Frauenfeld); *Arabian Gulf (Millet); *Zanzibar (Cook, Cheney); Seychelles! Bombay! Madagascar! (J. d. P.); Nikobar! Amboina! (Mus. Copenh.); Simon's Bay, Cape of Good Hope! (Essex Inst.); Timor, Molucca (Martens); Reef of Attago! (Brit. Mus.); *Sandwich Islands (Garrett); Feejee Islands! (Mus. Godeff.); *Hong Kong (Stimpson); *Sunda Straits (Couthouy); Ousima! (Stimpson, Smithson. Coll.); Philippine Islands! (Semper); *Society Islands, *Kingsmills Islands (Garrett).

(CIDARIS.) DOROCIDARIS.

Echinus LINN. 1758. Syst. Nat. (pars.)
Cidaris LESKE, 1778. Kl. Add. (pars.)
Cidarites LAMK. 1816. An. s. Vert. (pars.)
Phyllacanthus BRANDT, 1835. Prod. (pars.)
Leiocidaris DUJ. HUPÉ, 1862. Échin. (pars.)
Orthocidaris (**A. Agass.**) 1863. Bull. M. C. Z., I. p. 17 (non COTTEAU).
Dorocidaris A. AGASS. 1869. Bull. M. C. Z., I.

Dorocidaris papillata

..... GUALTERI, 1742. Index, *Pl. CVIII. f. D.*
Cidaris **papillata** LESKE, 1778. Kl. Ech., p. 61, *Pl. XXXIX. f. 2*, copied Enc. M., *Pl. CXXXVI. f. 6, 7.*
" *papillata* FLEM. 1828. Brit. An., p. 477.
" " !? FORBES, 1841. Brit. Starf., p. 146, fig. Scotland.
" " ! DÜB. o. KOR. 1844. Skand. Ech., p. 255, *Pl. IX. f. 25–34.*
" " PHIL. 1845. Wieg. Arch., I. p. 353.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 326.
" " ! GRAY, 1848. Brit. Rad., p. 2.
" " ! SARS, 1861. Norges Echin. W. coast Norway.
Cidarites " DESML. 1837. Syn., p. 320.
Leiocidaris " ! DUJ. HUPÉ, 1862. Échin., p. 485.
" " ! PERRIER, 1869. Pédic, p. 129.
Orthocidaris papillata ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17.
Dorocidaris " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 253.
Cidarites **hystrix** ! LAMK. 1816. An. s. Vert., p. 55. Mediterranean.
" *hystrix* DESML. 1837. Syn, p. 320.
Cidaris " ! BLAINV. 1834. Actinol., p. 231, *Pl. XXbis f. 5.*
" " SARS, 1835. Beskriv., p. 40.
" " ! AGASS. 1836. Prod., p. 21.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 326.
" " PHIL. 1845. Wieg. Arch., I. p. 353.
" " ARADAS, 1853. Atti. Gioen., VIII. p. 162. Sicily.
" " SARS, 1861. Middelh. Litt. Fauna, p. 109. Naples.
Phyllacanthus *hystrix* BRANDT, 1835 Prod., p. 268.
Leiocidaris " ! DUJ, HUPÉ, 1862. Échin., p. 484.
" " ! PERRIER, 1869. Pédic, p. 129, *Pl. III. f. 11.*
Orthocidaris " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17. Nice.
Dorocidaris " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 253.
Cidaris **borealis** ! DÜB. o. KOR. 1844. Ak. Stork., p. 114. W. coast Norway.
" **affinis** PHIL. 1845. Wieg. Archiv., I. p. 351. Sicily.
" *affinis* SARS, 1857. Middelh. Litt. Fauna, p. 109. Naples.
Leiocidaris affinis DUJ. HUPÉ, 1862. Échin., p. 485.
Orthocidaris affinis ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17.
Dorocidaris " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 253.
Cidaris **Stokesii** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 326. Mediterranean.
Leiocidaris Stokesii ! DUJ. HUPÉ 1862. Échin., p. 485.
" " ! PERRIER, 1869. Pédic, p. 131, *Pl. III. f. 6 a, b, c.*
Dorocidaris abyssicola ! A. AGASS. 1869. Bull. M. C. Z., I. p. 253. Straits of Florida.

*W. coast Norway (M. Sars); *Fishing Bk., Storeggen, 80–100 fms. (G. O. Sars); Bergen! (J. d. P.); *North Sea, 200 fms. (Mus. Stockholm); *Shetland Islands! (Liverpool Mus.); *Cape Wrath! 280 fms., *Cape Sagras, 165 fms., *So. Ireland, 80–90 fms. (Porcup. Exp.); *Mediterranean; *Nice (Verany); *W. coast Italy (Rigacci); *Naples (Panceri); Adriatic (Müller); Lessina, Lissa (Heller); *Carysfort Reef, 40–60 fms., Conch Reef, 40 fms., *Florida Gulf Stream, 195 fms., *French Reef, Florida, 45 fms., *Key West, 135 fms., off Tortugas, 60 fms., *Tennessee Reef, 114 fms., *Alligator Reef, 114 fms., *Sundry Stations, Florida Gulf Stream, 98, 116, 125, 152, 154 fms. (Pourtalès); Guadeloupe! (Duchassaing, J. d. P.).

ECHINANTHUS.

Echinanthus Breyn. 1732. Schedias. (pars.)
Echinus Lin. 1758. Syst. Nat. (pars.)
Echinanthus Leske, 1778. Kl. Add. (pars.)
" Gray, 1825. Ann. Phil. (pars.)
Clypeaster Lamk. 1801. An. s. Vert. (pars.)
Clypeaster Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 129. (pars.)
Echinanthus Gray, 1851. Proc. Zoöl. Soc. Lond. (pars.)
Clypeaster Müll. 1854. Bau d. Echin.
Echinanthus Gray, 1855. Cat. R. Echin. (pars.)

Echinanthus rosaceus

..... Sloane, 1725. Jam., *Pl. CCXLII. f. 6–11.*
..... Seba, 1758. Thes., III. *Pl. XI. f. 2, 3, 13, 14.*
Scutum *angulare humile* ! Klein, 1734. *Pl. XVII. f. A, Pl. XVIII. f. B,* copied, E. M., *Pl. CXLV. f. 5, 6.*
..... Knorr, 1771. Délic., *Pl. DI. f. 12.*
..... Enc. Méth., *Pl. CXLIV. f. 7, 8.*
Echinus **reticulatus** Linn. 1758. Syst. Nat., p. 666. (pars).
Echinus reticulatus Gmel. 1788. Lin. Syst. Nat., 3191. (pars).
" **rosaceus** Linn. 1758. Syst. Nat.
Clypeaster *rosaceus* ! Lamk. 1801. An. s. Vert., p. 349.
Clypeaster " ! Lamk. 1816. An. s. Vert., p. 14. Ocean Indian ? N. American.
" " ! Blainv. 1834. Actinol., p. 216, *Pl. XVII. f. 1, 2.*
" " ! Agass. 1836. Prod., p. 187.
" " Desml. 1837. Syn., p. 212.
" " ! Edw. in Cuv. Règ. An. Ed. Ill., *Pl. XVI. f. 1.*
" " ! Agass. Des. 1847. C. R. Ann. Sc. Nat., VII. p. 129. West Indies.
" " Müll. 1854. Bau d. Ech., *Pl. IV. f. 1, 3–5; Pl. V. f. 5–9.*
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 14, 16, 17.*
" " ! Mich. 1861. Clyp. Monog., *Pl. XIII.*
" " ! Duj. Hupé, 1862. Échin., p. 571, *Pl. X. f. 1–8.*
" " ! A. Agass. 1863. Bull. M. C. Z., p. 25. Florida.
" " ! Lütk. 1864. Bid., p. 100.
Echinanthus **humile** ! Leske, 1778. *Pl. XVII. f. A ; Pl. XVIII. f. B.*
" *rosaceus* ! Gray, 1825. Ann. Phil., p. 5.
" " Gray, 1855. Cat. Rec. Echin., p. 4. West Indies.
Clypeaster **incurvatus** Desml. 1837. Syn., p. 212.
" **parvus** ! Duch. 1847. Bull. Soc. Géol. fr., IV. 1093. Guadeloupe.
" *parvus* ! Agass. Des. 1847. C. R. Ann. Sc. Nat., VII. p. 130.
" " Duj. Hupé, 1862. Échin., p. 572.
Echinanthus parvus ! Gray, 1855. Cat. R. Echin., p. 8.
Clypeaster **albolineatus** ! Mich. MS. (Écol. Min.)

*Charleston, S. C. (Allansen) ; *Tortugas (Holder, Agassiz) ; *Key West (Pourtalès) ; *Jeremie, Hayti (Weinland) ; *Jamaica (Adams) ; *Nassau (Shaw) ; *Bahamas (Bryant) ; Cuba ! (Arango) ; Guadeloupe ! (Écol. Min.).

Echinanthus testudinarius

Echinanthus **testudinarius** ! Gray, 1851. Proc. Zoöl. Soc. Lond., p. 35.
" *testudinarius* ! Gray, 1855. Cat. Echin., p. 6, *Pl. I. f. 1.* Borneo ?
Clypeaster " ! Mart. 1866. Wieg. Arch., I. p. 170. Timor.
" " ! Verrill, 1871. Notes Rad., p. 588, *Pl. X. f. 7.*
Echinanthus **Australasiae** ! Gray, 1851. Proc. Zoöl. Soc. Lond., p. 34. Australia.
" *Australasiae* ! Gray, 1855. Cat. R. Ech., p. 5, *Pl. I. f. 2.*
Clypeaster **tumidulus** ! Müll. 1854. Bau d. Ech., p. 90.

Echinanthus testudinarius (*continued*).

Clypeaster **speciosus** ! VERRILL, 1870. Sill. Journ., p. 95. La Paz.
" **Desorii** ! MICH. MS. (Écol. Min.).
" **Australiae** ! MICH. MS. (Écol. Min.).

*Hakodadi (Dall, Smithson. Coll.); *New Holland (Écol. Min.); Red Sea! (J. d. P.); Japan! (Bonn Mus.); Australia! (Brit. Mus.); Sandwich Islands! (Breslau Mus.); *La Paz (Pedersen, Yale Coll.).

(SCUTELLA.) ECHINARACHNIUS.

Scutella LAMK. 1816. An. s. V. (pars.)
Echinarachnius GRAY, 1825. Ann. Phil. (non LESKE).
Echinodiscus BLAINV. 1834. Actinol. (pars.)
Echinarachnius AGASS. 1841. Mon. Scut.
Dendraster AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 315.
Scaphechinus BARN. 1863. In A. AG. Proc. A. N. S. Phila.
Chaetodiscus LÜTK. 1864. Bid. till Kunds. om Echin.

Echinarachnius excentricus

Scutella **excentrica** ESCH. 1829. Zoöl. Atl., *Pl. XX. f. 2.* Kamtchatka.
Echinarachnius excentricus ! VAL. 1846. Voyage Vénus, Zooph., *Pl. X.*
Dendraster " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 135. California.
Dendraster " ! GRAY, 1855. Cat. Rec. Ech., p. 16.
" " ! STIMPS. 1857. Crust. Ech., Pacific Sh., p. 87.
" " ! DUJ. HUPÉ, 1862. Échin., p. 564.
Scutella striatula ! CONRAD, 1856. Pacif. R. R. Survey, VII. p. 196, *Pl. IX. f. 1 a, b* (non M. DE SERRES).

*Monterey (Trowbridge); *San Francisco (A. Agassiz, Cary); *Puget Sound (Kennerly), Smithson. Coll.); Sitka, Unalach, Kamtchatka (Eschscholtz).

Echinarachnius mirabilis

Scaphechinus mirabilis ! BARN. 1863. In A. AG. Proc. A. N. S. Phila, p. 359. Hakodadi.
Scaphechinus mirabilis ! VERRILL, 1869. Proc. Bost. S. N. H., p. 384.
Chaetodiscus scutella ! LÜTK. 1864. Bid., p. 104., *Pl. II. f. 11.*
Scutella **japonica** ! MART. 1865. Monatsb. Berl. Ak., p. 140, March. Yedo.
Scutella japonica ! MART. 1866. Wieg. Archiv., I. p. 138.

*Hakodadi (W. Stimpson, Dall, Smithson. Coll.); *Japan (Salmin); Yokohama! (Mus. Berlin, Smithson. Coll.); Yedo, Kanagawa (Martens).

Echinarachnius parma

Scutella parma ! LAMK. 1816. An. s. Vert., p. 11.
Scutella parma BLAINV. 1827. D. S. N. Scut., p. 226.
" " DESML. 1837. Syn., p. 230.
Echinodiscus parma BLAINV. 1834. Actin., p. 218.
Echinarachnius parma ! GRAY, 1825. Ann. Phil., p. 6.
" " ! AGASS. 1836. Prod., p. 188.
" " ! AGASS. 1841. Mon. Scut., p. 89, *Pl. XX. f. 9–18.* Canada.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 133.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 15. Atlantic Ocean.
" " ! MICH. 1859. Rev. Mag. Zoöl., No. 9.
" " ! DUJ. HUPÉ, 1862. Échin., p. 562, *Pl. X. f. 13–17.*
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 26. New England.
" " ! A. AGASS. 1865. Seaside Stud., figs. 130 – 140. Mass. Bay.
" " ! VERRILL, 1866. Proc. Boston Soc. N. H., p. 340, 351.

Echinarachnius parma (*continued*).

Scutella **trifaria** SAY, 1826. Jour. Ac. N. S. Phila., p. 227.
" **Rumphii** ! BLAINV. 1827. Dict. Sc. Nat. Scut., p. 226.
Echinodiscus Rumphii ! BLAINV. 1834. Actin., p. 218.
Echinarachnius " ! AGASS. 1836. Prod., p. 188.
" " ! AGASS. 1841. Mon. Scut., p. 91, *Pl. XXI. f. 1–6.* Amboina?
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 135.
" " ! GRAY, 1855. Cat. Rec. Ech, p. 15. Indian Ocean.
" " ! MICH. 1859. Rev. Mag. Zoöl., No. 9.
" " ! DUJ. HUPÉ, 1862. Échin., p. 562.
" **Atlanticus** ! GRAY, 1841. In AGASS. Mon. Scut., p. 92, *Pl. XXI. f. 32–34.* Newfoundland.
" *Atlanticus* ! STIMPS. 1853. Invert. Grand Menan, p. 16.
" " ! MICH. 1859. Rev. Mag. Zoöl., No. 9.
" " ! DUJ. HUPÉ, 1862. Échin., p. 562.
" **Asiaticus** ! MICH. 1859. Rev. Mag. Zoöl., No. 9, *Pl. XIII. f. 3.* Kamtchatka.
" *Asiaticus* ! A. AGASS. 1863. Prod. A. N. S., Phila., p. 359. Avatscha Bay.
" " ! DUJ. HUPÉ, 1862. Échin., p. 563.
" " ! VERRILL, 1869. Proc. Boston Soc. N. H., p. 384. Aleutian Islands.
" **Australiae** ! MICH. 1859. Rev. Mag. Zoöl., No. 9, *Pl. XIII. f. 2.* Australia.
" *Australiae* ! DUJ. HUPÉ, 1862 Échin., p. 563.
" **undulatus** ! MICH. 1859. Rev. Mag. Zoöl., No. 9, *Pl. XIII. f. 1.*
" *undulatus* ! DUJ. HUPÉ, 1862. Échin., p. 563.

Long Island Sound! (Verrill); *New Jersey (Gedney, Smithson. Coll.); *Gay Head, *Nantucket, *South Shoals, Mass. (Agassiz); *Cape Cod (Atwood); *Mass. Bay (Agassiz); *St. George's Bank (Atwood); *Trenton Pt., Me. (Verrill, Shaler, Hyatt); *Eastport (Verrill); *Grand Menan (Mills); Gaspé (Dawson); Long Island (Say); Labrador! (Brit. Mus.); Mingan Islands! 2–15 fms., Straits Belle Isle! (Packard); *Avatscha Bay, *Kamtchatka, 30–70 fms. (W. Stimpson); *E. Vancouver Island; Aleutian Islands! (Smithson. Coll.); New Holland! (J. d. P., Écol. Min.); Indian Ocean! (Bonn Coll.); Red Sea! (Écol. Min.); India! (Brit. Mus.).

ECHINOBRISSUS.

Echinobrissus BREYN. 1732. Schedias. (pars.)
Echinobrissus GRAY, 1825. Ann. Phil.
" D'ORBIG. 1854. Rev. Mag. Zoöl. (pars.)
Nucleolites LAM. 1801. Syst. a. s. V. (pars.)

Echinobrissus recens

Nucleolites **recens** ! EDW. 1836, in CUV. Règ. An. Ed. Ill., *Pl. XIV. f. 3.*
" " AGASS. 1849. C. R. Ann. Sc. Nat., VII. p. 153. New Holland.
Echinobrissus recens D'ORBIG. 1854. Rev. Mag. Zoöl., p. 24.
" " DESOR, 1857. Échin. foss., p. 257.
" " ! DUJ. HUPÉ, 1862. Échin., p. 578, *Pl. X. f. 9, 10.*

Madagascar! New Zealand! (Brit. Mus.); Mers Australes! (J. d. P.); *M. C. Z.

ECHINOCARDIUM.

Echinospatagus Breyn. 1732. Sched. (pars.)
Spatagus Müll. 1776. Zool. Dan. Prod. (pars.)
Echinocardium Gray, 1825. Ann. Phil. (pars.)
Amphidetus Agass. 1836. Prodromus.
Amphidetus Agass. 1847. C. R. Ann. Sc. Nat., VIII.
Amphidotus Forbes, 1841. Brit Starf.
Echinocardium Gray, 1855. Cat. Rec. Ech.

Echinocardium australe

Echinocardium **australe** ! Gray, 1851. Ann. Mag. N. H., p. 131. Australia.
" *australe* ! Gray, 1855. Cat. R. Ech., p. 44, *Pl. IV. f. 1.* Van Diemen.
" " ! Duj. Hupé, 1862. Échin., p. 602.
" **Zealandicum** ! Gray, 1851. Ann. Mag. N. H., p. 131. New Zealand.
" *Zelandicum* ! Gray, 1855. Cat. R. Ech., p. 44.
" " ! Duj. Hupé, 1862. Échin., p. 602.
" **Stimpsoni** ! A. Agass. 1863. Proc. A. N. S. Phila., p. 360. Cape Good Hope.
Amphidetus **Novae Zelandiae** ! Val. 1869. Perrier, Péd., p. 176.

*New Zealand (J. d. P.); *Tshifu, China (Novarra Exp.); *Kagosima, Simon's Bay ! 12 fms. (W. Stimpson, Smithson. Coll.); *Mussell Bay (Mus. Godeff.); Van Diemen ! Port Jackson ! W. Australia ? (Brit. Mus.); So. Africa ! (Mus. Stutt.); Mozambique (Bianconi); China Seas ! East India ! (Mus. Copenh.).

Echinocardium cordatum

Echinus guineensis cordiformis Seba, 1758. Thes., III., *Pl. X. f. 21.*
..... Knorr, 1771. Délic., *Pl. DI. f. 14.*
Echinospatagus *cordiformis* ..... Breyn. 1732. p. 61, *Pl. V. f. 5.*
Spatangus sp. 2, § 99, Klein, 1732. *Pl. XXIV. f. c, d, e.*
Echinus **cordatus** Penn. 1777. Brit. Zoöl., IV. p. 58, *Pl. XXXIV. f. 2; Pl. XXXVI. f. 2,* 2d ed. 1812.
Spatangus cordatus Flem. 1828. Brit. An., p. 480 (non Blainv.).
Amphidotus *cordatus* Forbes, 1841. Brit. Starf, p. 190, *f.* Scotland.
Amphidetus " ! Düb. o. Koren, 1844. Zool. Bid., p. 285. W. coast Norway.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VIII. p. 11, *Pl. XVI. f. 8.*
" " Müll. 1848. Achaeol., I. *Pl. III. Pl. IV. f. 6–8.* Pluteus.
" " Müll. 1854. Bau d. Ech., *Pl. III. f. 3–5.*
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 22.*
Echinocardium " ! Gray, 1848. Brit. Rad., p. 6.
" *cordatum* ! Gray, 1855. Cat. R. Ech., p. 43. North Sea.
" " ! Des. 1858. Syn. Ech. foss., *Pl. XLIII. f. 4, 5.*
" " ! Duj. Hupé, 1862. Échin., p. 602.
" " ! A. Agass. 1863. Bull. M. C. Z., I.
Spatangus pusillus Leske, 1778. Kl. Add., p. 166, *Pl. XXIV. f. c, d, e* (non Müll.).
" " Blainv. 1834. Actin., p. 201.
Echinocardium *pusillus* Gray, 1825. Ann. Phil., p. 8.
Amphidetus *pusillus* Agass. 1836. Prod., p. 184.
Spatangus flavescens Abild. 1789. Zool. Dan., *Pl. XCI. f. 1–4* (non Müll. Prod.).
" *lacunosus* Müll. Zool. Dan. Text. (non Linn.).
Spatangus **arcuarius** ! Lamk. 1816. A. s. V., p. 32. Brit. Channel.
" *arcuarius* Desl. 1824. Enc. Méth., *Pl. CLVI. f. 7, 8.*
" " Blainv. 1834. Actin., p. 201.
" " Desml. 1837. Syn., p. 378.

Echinocardium cordatum (*continued*).

Echinocardium Seba GRAY, 1825. Ann. Phil, p. 8.
Amphidetus *Sebae* AGASS. 1836. Prod., p. 184.
Amphidetus **Kurtzii** ! GIR. 1852. Proc. Boston Soc. N. H., p. 213. So. Carolina.
Echinocardium Kurtzii ! A. AGASS. 1869. Bull. M. C. Z., 1. No. Carolina.
? *Amphidetus* **ampliforus** M'CRADY, 1857. Plioc. foss. So. Ca., p. 6, *Pl. II. f. 2.*
? " **gothicus** RAVEN. 1848. Echin. So. Ca.
? " *gothicus* M'CRADY, 1857. Plioc. foss. So. Ca., p. 6, *Pl. II. f. 3.*

*Christianiafjord (G. O. Sars); *Kattegatt (Mus. Copenh.); *Irish Sea (Thos. J. Moore); *Oban (W. Stimpson); *English Channel; *W. coast Italy (Rigacci); Finmark, Oresund (Sars); Drontheim — N. Cape, 15 fms. (McAndrew & Barrett); Shetland (Norman); Great Britain (Forbes); Scheveningen (Maitland); Bahia! (Mus. Godeff.); Charleston, S. Ca. (Agassiz); *off Tennessee Reef, Florida, 79 fms. (Pourtalès); *Beaufort, N. C. (Bickmore).

Echinocardium flavescens

Spatagus flavescens MÜLL. 1776. Prod., p. 235 (non ABILD.).
Spatangus ovatus FLEM. 1824. Wern. Mem., 484 (non LESKE nec LAM.).
" " FLEM. 1828. Brit. An , p. 40.
" " ! BLAINV. 1834. Actin., p. 202.
" " DESML. 1837. Syn., p. 388.
Amphidetus ovatus ! DÜB. o. KOR. 1844. Skand. Ech., p. 283, *Pl. X. f. 50.* Norway.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 12.
" " ! SARS, 1861. Norges Ech., p. 98.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 27.
" " ! PERRIER, 1869. Pédic., p. 175, *Pl. VII. f. 2*, et No 193, p. 176.
Echinocardium ovatum ! GRAY, 1848. Brit Rad., p. 6.
" " ! GRAY, 1855. Cat. R. Ech., p. 43. North Sea.
" " ! DUJ. HUPÉ, 1862. Échin., p. 602.
" " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 276. Straits Florida.
Amphidotus roseus ! ? FORBES, 1841. Brit. Starf. p. 194.

*Oresund (Eschricht); W. coast Norway (Sars); Lofoten Islands, 20, 30 fms. (G. O. Sars); *So. Ireland, *Cape Wrath, 100 fms. (Porcupine Exped.); Bergen, Finmark, Kattegatt (Sars); Drontheim — Cape North, 20 – 40 fms. (McAndrew & Barrett); Shetland Islands, Dublin, Belfast, Cornwall (Forbes); Shetland Islands (Norman); *Charleston, S. C. (Kurtz); *Florida Gulf Stream, 138 fms., *off Tennessee Reef, 85 – 115 fms. (Pourtalès).

Echinocardium mediterraneum

Amphidetus **mediterraneus** ! ? FORBES, 1844. Journ. Lin. Soc. Lond. Ægean Sea.
" *mediterranneus* ! ? FORBES, 1844. Ann. Mag. N. H., XIV. p. 413.
" " AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 12.
" *mediterranus* SARS, 1857. Middelh. Litt. Faun., p 117. Naples.
Echinocardium mediteraneum ! GRAY, 1855. Cat. R. Ech., p. 44.
" " DUJ. HUPÉ, 1862. Éch., p. 602.
Amphidetus **gibbosus** ! AGASS. 1847. Ann Sc. Nat., VIII. p. 11. Algeria, Sicily.
Echinocardium gibbosum ! GRAY, 1855. Cat. R. Ech., p. 44.
" " ! DUJ. HUPÉ, 1862. Échin., p. 602.

Amphidetus **sp.** ARADAS, 1850. Atti. Gioen., VI. p. 80. Catania.

*Naples (Panceri); *Mediterranean; *Cette; *Bone, Algeria; Triest, Naples (Sars); Sicily (Gray); Genoa, Nice (Verany); Zara, Lessina, 2 – 20 fms. (Heller); Ægean Sea (Forbes).

Echinocardium pennatifidum

? *Echinocardium* **pennatifidum** NORM. 1868. 4th Rept. Dredging Shetland Islands, p. 440.
" *pennatifidum* HODGE, 1871. Trans. North. Durh., IV. *Pl. V.*
" **laevigaster** ! A. AGASS. 1869. Bull. M. C. Z., I. p. 277. Straits Florida.
? *Amphidotus gibbosus* (**Barrett,**) 1857. Ann. Mag. N. H., XIX. p. 32, *Pl. VII. f. 2* (non AGASS.).
? *Spatangus* **orthonotus** CONRAD, 1843. Proc. Phila. Ac. N. S., p. 327.
? *Amphidetus orthonotus* M'CRADY, 1857. Plioc. Foss. So. Ca., *Pl. II. f. 1.*
? *Echinocardium orthonotus* ! CONRAD, 1865. Proc. Ac. N. S. Phila.
? *Amphidetus* **virginianus** FORBES, 1849. Q. J. Geol. Soc. Lond., I. p. 425.

Northumberland (Hodge); *off Alligator Reef, 79 fms., *off Sombrero, 121 fms., *off Tennessee Reef, 114 fms. (Pourtalès); Shetland (Norman); Clyde District (Robertson).

ECHINOCYAMUS.

Echinocyamus VAN PHEL. 1774. Brief.
Spatagus MÜLL. 1776. Prod. Zool. Dan. (pars.).
Echinus GMEL. 1788. LINN. Syst. Nat. (pars.).
Fibularia LAMK. 1816. A. s. Vert. (pars.)
Echinocyamus AGASS. 1841. Mon. Scut.
Scutellina AGASS. 1841. Mon. Scut.

Echinocyamus pusillus

Echinus **perexiguus** PETIV. 1764. Gaz., *Pl. XXXI. f. 10.*
..... KNORR, 1771. Délic., *Pl. DI. f. 10.*
Spatagus pusillus MÜLL. 1776. Prod., 2851. Zool. Dan., *Pl. XCI. f. 5, 6.*
Echinocyamus pusillus ! GRAY, 1825. Ann. Phil., p. 6.
" " FLEM. 1828. Brit. An., p. 481.
" " ! AGASS. 1841. Mon. Scut., p. 128, *Pl. XXVII. f. 1–8.* German Ocean.
" " ! ? FORBES, 1841. Brit. Starf., p. 175, fig.
" " PHIL. 1845. Wieg. Archiv, I. p. 356.
" " GRAY, 1848. Brit. Rad., p. 5.
" " MÜLL. 1853. Abhdl., I. *Pl. VII. f. 4;* Abhanl., VII. *Pl. VIII.* Pluteus.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 28. Atlantic Ocean, Mediterranean.
" " SARS, 1857. Middelh. Lit. Faun., p. 116.
" " DUJ. HUPÉ, 1862. Échin., p. 556.
" " PERRIER, 1869. Pédic, p. 167.
" **angulosus** LESKE, 1778. KL. Add., p. 215.
" *angulosus* ! AGASS. 1841. Mon. Scut., p. 130, *Pl. XXVII. f. 14–18.*
" " ! DÜB. o. KOREN, 1844. Skand. Ech., p. 279.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 140.
" " SARS, 1861. Norges Ech., p. 95.
" " ! DUJ. HUPÉ, 1862. Échin., p. 556.
" " ! PERRIER, 1869. Pédic, p. 167.
Fibularia angulosa DE FRANCE, 1820. D. S. N., XVI. p. 515.
" " DESML. 1837. Syn., p. 236.
Echinocyamus **vicia** LESKE, 1778. KL. Add.
" **ovalis** LESKE, 1778. KL. Add., p. 152, *Pl. XXXVII. f. 6.*
Echinus **pulvinulus** PENN. 1812. Brit. Zool., 2d ed., p. 140, *Pl. XXXVIII. f. 1–4.*
Echinocyamus minutus ! BLAINV.† 1834. Actin., p. 214.
Fibularia equina ARADAS, 1850. Monog. Ech., p. 203. Sicily.

† There is considerable doubt as to the authenticity of the specimens ascribed to LAMARCK and BLAINVILLE in the Jardin des Plantes.

Echinocyamus pusillus (*continued*).

Fibularia tarentina ! Lamk. 1816. A. s. Vert., p. 17. Mediterranean.
Fibularia " Deslong. 1824. Enc. Méth., II. p. 389.
" " Risso, 1826. Europ. Mérid., V. p. 283.
" " Desml. 1837. Syn., p. 236.
" " Blainv. 1834. Actin., p. 211, *Pl. XVI. f. 6.*
" " Duj. Hupé, 1862 Échin., p. 557.
Echinocyamus tarentinus Gray, 1825. Ann Phil., p. 6.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 140.
" " Bronn, 1859. Kl. u. Ord. Actin., p. 339, *Pl. XXXIX. f. 24; Pl. XLI. f. 13.*
" " Perrier, 1869. Pédic, p. 167.
" **minimus** ! Gir. 1850. Proc. Boston S. N. H.
" **parthenopaeus** Costa, 1871. Echinoc. viv. e. foss.
" **speciosus** Costa, 1871. Echinoc. viv. e. foss.

*W. coast Norway (Sars); *W. seas of Europe; Oban (W. Stimpson); *Lofoten Islands, 300 fms. (G. O. Sars); *W. coast Sweden (Mus. Stockh.); Oresund (Mus. Copenh.); Devon, Scotland, E. & W. coast Britain (Forbes); Drontheim — Cape North, 15 – 25 fms. (McAndrew & Barrett); Arran Berwick (Gray); Nord See (Maitland); N., E., S. Ireland (Thomson); Iceland (Steenstrup); Shetland (Norman); *Carysfort Reef, 117, 138 fms., *Bocca grande, 125 fms., *Sand Key, 100, 120, 325 fms., *off Alligator Reef, 147, 138, 110, 79 fms., *Conch Reef, 169, 139, 117 fms., *Key West, 138, 130, 125 fms., *Tennessee Reef, 183, 115, 114, 75 fms., *Salt Key, 5 fms. (Pourtalès); *Naples (Panceri); *Corsica (Cotteau); *Civita Vecchia (Rigacci); *Mediterranean; Adriatic (Müller); Nice (Risso); Genoa! (Verany); Palermo! Egypt! (J. d. P.); Lissa, Lessina, Ragusa, Adriatic (Heller); Lussin (Grube); *Fayal! (Higginson); Josephine Bk.! (Mus. Stockh.).

ECHINODISCUS.

Echinus Rumph. 1705. Amb. Rar. Kam. (pars.)
Mellita Klein, 1734. Nat. Disp. Ech. (pars.)
Echinodiscus Leske, 1778. Kl. Add. (pars.)
Scutella Lamk. 1816. A. s. Vert. (pars.)
Echinodiscus Gray, 1825. Ann. Phil. (pars.)
Lobophora (**Agass.**) 1841. Monog. Scut. (non Curt. 1825, nec Serville, 1839).
Amphiope Agass. 1840. Cat. Syst. Ectyp.
Amphiope Agass. 1841. Monog. Scut.

Echinodiscus auritus

Echinus **planus** ..... Rumph. 1705. *Pl. XIV. f. F*; copied Enc. Méth., *Pl. CLII.* Amboina. (pars.)
Echinanthus maximus ..... Seba, 1758. Thes, III. *Pl. XV. f. 1–4*; copied Enc. Méth., *Pl. CLI. f. 5, 6.*
Echinodiscus **auritus** Leske, 1778. Kl. Add., p. 136.
" *auritus* ! Gray, 1825. Ann. Phil., p. 6.
Echinus auritus Gmel. 1788. Linn. Syst. Nat., 3189.
Scutella aurita ! Blainv. 1834. Actin., p. 220.
" " ! Agass. 1836. Prod., p. 188.
Lobophora aurita ! Agass. 1841. Mon. Scut., p. 70, *Pl. XIII. f. 1; Pl. XIV. f. 3–7.*
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 136.
" " ! Duj. Hupé, 1862. Échin., p. 565.
Echinodiscus **inauritus** Leske, 1778. Kl. Add., p. 38.
" *inauritus* ! Gray, 1825. Ann. Phil., p. 6.
" *inaurita* ! Gray, 1855. Cat. Rec. Ech., p. 21.
Echinus inauritus Gmel. 1788. Linn. Syst. Nat., 3190.

Echinodiscus auritus (*continued*).

Scutella inaurita ! Blainv. 1834. Actin., p. 220.
" " ! Agass. 1836. Prod., p. 188.
..... Andouin in Savigny, Égypte Zooph. Éch., *Pl. VII. f. 3.* Red Sea.
Scutella bifissa ! Lamk. 1816. A. s. Vert., p. 10.
Scutella bifissa ! Blainv. 1827. Scut. D. S. N., p. 224.
" " Desml. 1837. Syn., p. 226.
Lobophora bifissa ! Agass. 1841. Mon. Scut., p. 67, *Pl. XIII. f. 2–6; Pl. XIV. f. 1, 2.* Zanzibar.
" " ! Mich. 1845. Rev. Mag. Zoöl., p. 8. Isle de France.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 136.
" " ! Duj. Hupé, 1862. Échin., p. 565.
" " ! Mart. 1866. Wieg. Arch., p. 177.
" **Dubusii** Belval, 1863. Bull. Ac. Brux., XVI. p. 198.
" **Agassizii** Belval, 1863. Bull. Ac. Brux., XVI. p. 198.

*Zanzibar (Ashby, Ropes, Cook); *Red Sea ! (J. d. P.); Mozambique (Peters); Suez ! Mauritius ! India ! (Brit. Mus.); Bourbon ! (Écol. Min.); Amboina (Martens); Philippine Islands ! (Semper).

Echinodiscus biforis

Mellita laevis Klein, 1734. Nat. Disp. Ech., *Pl. XXI. f. A, B.* (pars.)
..... Knorr, 1771. Délic., *Pl. DI. f. 15.*
Echinodiscus **bisperforatus** Leske, 1778. Kl. Add., p. 132, *Pl. XXI. f. A, B.*
Echinus **biforis** Gmel. 1788. Linn. Syst. Nat., 3188.
Lobophora biforis Mart. 1866. Wieg. Arch., p. 177. Java.
Scutella *bifora* ! Lamk. 1816. An. s. Vert., p. 10 (non Blainv. nec Desml.).
Scutella " Agass. 1836. Prod., p. 188.
Echinodiscus bifora ! Gray, 1825. Ann. Phil., p. 6.
" " ! Gray, 1855. Cat. Rec. Ech., p. 20.
Lobophora " ! Agass. 1841. Mon. Scut., p. 64, *Pl. XII.* Madagascar.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 136.
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 5.*
" " ! Duj. Hupé, 1862. Échin., p. 565.
Scutella **bilinearifora** Desml. 1837. Syn., p. 226.
Lobophora **Desmoulinsii** Mich. MS. (Écol. Min.)

*Madagascar, *Mussell Bay, Cape Good Hope (Mus. Godeff.); Red Sea ! (J. d. P.); Mozambique (Peters); Java (Martens).

Echinodiscus laevis

Mellita laevis ! Klein, 1734. Nat. Disp. Ech. (pars.)
Echinodiscus **bisperforatus** Leske, 1778. Kl. Add. (pars.)
Scutella bifora ! Blainv. 1827. D. S. N. Scut., p. 223 (non Lamk.).
" *bifora* Desml. 1837. Syn., p. 226.
" *biforis* ! Blainv. 1834. Actin., p. 219.
Lobophora **truncata** ! Agass. 1841. Mon. Scut., p. 66, *Pl. XI. f. 11–16.*
" *truncata* ! Agass. 1847. C. R. Ann. Sc Nat., VII. p. 136.
" " ! Duj. Hupé, 1862. Échin , p. 565.
Echinodiscus " ! Gray, 1855. Cat. Rec. Ech., p. 20.
Lobophora **tenuissima** ! Val. 1847. Agass. C. R. Ann. Sc. Nat., VII. p. 136. Waigiou.
" *tenuissima* Belval, 1863. Bull. Ac. Brux., XVI. p. 198.
Echinodiscus tenuissima ! Gray, 1855. Cat. Rec. Ech., p. 20.
Lobophora **Deplanchei** ! Mich. 1861. Rev. Mag. Zoöl., p. 327, *Pl. IX. f. 1.* New Caledonia.
" **texta** ! A. Agass. 1863. Proc. A. N. S. Phila., p. 359. Japan.

*Ousima (W. Stimpson, Smithson. Coll.); *New Caledonia (Crosse); Tanegasima ! China Seas, Lat. 23° N., 20 fms. ! (W. Stimpson, Smithson. Coll.); Linguin, China Seas (Liverpool. Mus.); So. Africa ! (Mus. Godeff.); Penang ! (Mus. Copenh.); Waigiou ! (J. d. P.); Burmah ! (Nat. Hist. Soc. Bost.).

ECHINOLAMPAS.

Echinanthus Breyn. 1732. Schedias. (pars.)
Scutum Klein, 1734. Nat. Disp. Ech. (pars.)
Echinanthus Leske, 1778. Kl. Addit. (pars.)
Echinus Gmel. 1788. Linn. Syst. Nat., 3187. (pars.)
Nucleolites Lamk. 1801. An. s. Vert. (pars.)
Clypeaster Lamk. 1816. An. s. Vert. (pars.)
Echinolampas Gray, 1825. Ann. Phil.
Echinolampas Agass. 1847. C. R. Ann. Sc. Nat., VII.
Echinanthus D'Orbigny, 1854. Rev. Mag. Zoöl.

Echinolampas depressa

Echinolampas **depressus** ! Gray, 1851. Ann. Mag. N. H., p. 38.
" *depressus* ! Gray, 1855. Cat. Rec. Ech., p. 36, *Pl. II. f. 4.*
" **caratomoides** ! A. Agass. 1869. Bull. M. C. Z., I. p. 269. Straits of Florida.

*Off Tortugas, 35, 68 fms., *off Carysfort Reef, 40, 60, 98, 320 fms., *off Conch Reef, 77 fms. (Pourtalès).

Echinolampas Hellei

Echinolampas Richardi (Desml.) 1837. Tab. Syn., p. 340 (non Desmt.). Senegal.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 163.
" " ! Gray, 1855. Cat. Rec. Ech., p. 36.
Echinanthus Richardi ! D'Orb. 1854. Rev. Mag. Zoöl., p. 21.
Echinolampas Laurillardi ! Desml. 1847. C. R. Ann. Sc. Nat., VIII. (non Agass.). Note of Jules Marcou.
" **Hellei** ! Val. 1869. Perrier, Pédic., p. 170.
" **Rangii** Desml. 1870. Act. Soc. Lin. Bordeaux, XXVII. *Pl. XX.*

*Cape Palmas (Dr. Perkins, Essex Inst.); Senegal ! mouth of Rio Grande (J. d. P.).

Echinolampas oviformis

Echinus sulcatus ..... Rumph. 1705. Amb. Rar. Kam., *Pl. XIV. f. 3.*
Scutum ovatum Klein, 1734. Nat. Disp. Ech., § 78, *Pl. XX. f. c, d.*
Echinanthus ovatus Leske, 1778. Kl. Add., p. 127, *Pl. XX. f. c, d.*
Echinus **oviformis** Gmel. 1788. Linn. Syst. Nat., 3187.
Nucleolites *oviformis* ! Lamk. 1801. An. s. Vert., p. 347.
Clypeaster " ! Lamk. 1816. An. s. Vert., p. 15.
" " ! Blainv. 1825. D. S. N., p. 190.
Echinolampas *oviformis* ! Gray, 1825. Ann. Phil., p. 7.
Echinolampas " ! Blainv. 1834. Actin., p. 209.
" " Desml. 1837. Syn., p. 340.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 163.
" " ! Gray, 1855. Cat. Rec. Ech., p. 35. Red Sea.
" " ! Mart. 1866. Wieg. Archiv, I. p. 178. Molucca.
" " ! Perrier, 1869. Pédic., p. 170.
Echinanthus oviformis D'Orb. 1854. Rev. Mag. Zoöl.
Echinus orientalis ..... Seba, 1758. Thes., III. *Pl. X. f. 23 a, b*, copied in Enc. Méth., *Pl. CXLIV. f. 1, 2.*
Echinolampas orientalis ! Gray, 1825. Ann. Phil.
Echinolampas orientalis Blainv. 1834. Actin., p. 209, *Pl. XVI. f. 2.*
" " ! Agass. 1836. Prod., p. 20.
" " Desml. 1837. Syn., p. 340.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 163.

Echinolampas oviformis (*continued*).

Echinolampas orientalis GRAY, 1855. Cat. Rec. Ech., p. 36.
Echinanthus " D'ORB. 1854. Rev. Mag. Zoöl.
Echinolampas **cyclostomus** ! PERRIER, 1869. Pédic., p 170.
" **Bottae.** MS. (J. d. P.).

*Mauritius (Pike); Red Sea (J. d. P.); Tranquebar! Cape Good Hope! (Mus. Copenh.); Molucca (Martens); Ceylon! (Brit. Mus.).

ECHINOMETRA.

Echinometra RONDEL. 1554. De Piscib. Mar. (BREYN.)
Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Echinus LINN. 1758. (pars.)
Echinometra GRAY, 1825. Ann. Phil.
Echinometra AGASS. 1846. C. R. Ann. Sc. Nat., VI.
Heliocidaris AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Ellipsechinus LÜTK. 1864. Bid. til ..... Echin.

Echinometra lucunter

..... GUALTERI, 1742. *Pl. CVII. f. c.*
Cidaris *variolata ellyptica*, 1, variol. freq.! KLEIN, 1734. Nat. D. Ech., *Pl. IV. f. C, D.*
" " " *β.* 2, variol. rarior.! KLEIN, 1734. Nat. Disp. Ech., *Pl. V. f. b, c.*
Cidaris lucunter LESKE, 1778. KL. Add., *Pl. IV. f. C, D.*
Echinus " ! LAMK. 1816. An. s. Vert., p. 50 (non LINN. nec LÜTK.). Inde. Isle de France.
" " ! BLAINV. 1825. Dict. Sc. Nat. O., p. 93.
Echinometra lucunter ! BLAINV. 1834. Actin., p. 225.
" " ! AGASS. 1836. Prod., p. 22.
" " DESML. 1837. Syn., p. 260.
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 10. Isle de France.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 372. Timor Straits. Philippine Islands. Cochin China.
" " ! DUJ. HUPÉ, 1862. Échin, p. 538.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 21. Sandwich Islands. Society Islands.
" " ! A. AGASS. 1863. Proc. Acad. N. S. Phila., p. 355. Ousima.
" " ! MART. 1866. Wieg. Arch., I. p. 164. Sumatra. Molucca. Amboina. Flores.
Echinus **Mathaei** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 93.
Echinometra Mathaei ! BLAINV. 1834. Actin., p. 225 (non AGASS.).
" " ! AGASS. 1836. Prod., p. 22.
" " DESML. 1837. Syn., p. 260.
" " ! GRUBE, 1857. Nov. Act., XXVII. p. 44.
" " ! DUJ. HUPÉ, 1862. Échin., p. 538.
" **heteropora** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 372. Zanzibar.
" *heteropora* ! DUJ. HUPÉ, 1862. Échin., p. 538.
" " ! PERRIER, 1869. Pédic., p. 161., *Pl. XVI. f. a, b.*
" **brunea** ! A. AGASS. 1863. P. A. N. S. Phila., p. 355. Bonin.
" *acufera* ! A. AGASS. 1863. Bull. M. C. Z., I. (non BLAINV.). Zanzibar.
" **microtuberculata** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 22. Kingsmills Islands. Sandwich Islands

*Zanzibar (Ropes, Cheney, Cook); *Mozambique (Cook); *Tor, Red Sea (Mus. Vienna); Madagascar (Liverpool Mus.); *Mauritius (Pike); Natal! (Mus. Stutt.); Philippine Islands! (Semper); Feejee Islands! Upolu! (Mus. Godeff.); Bourbon! (Écol. Min.); Cape Good Hope! (Smithson. Coll., Stimpson); *Society Islands, *Sandwich Islands, *Kingsmills Islands (Garrett); *Bonin, *Loo Choo Islands (Stimpson, Smithson. Coll.); New Caledonia! (Crosse); Samoa! Java! (Acad. N. S. Phila.); *Calcutta (Theobald); Seychelles! Cochin China! Samar! Straits Torres, Solomon Islands (J. d. P.); Arabian Gulf! Japan, Sumatra, Timor, Molucca, Flores, Adenare, Buru (Martens).

Echinometra macrostoma

Ellipsechinus macrostomus Lütk. 1864. Bid., p. 165, *Pl. I. f. 10.*

Echinometra oblonga

Echinus **oblongus** ! Blainv. 1825. Dict. Sc. N. O., p. 95.
Echinometra oblonga ! Blainv. 1834. Actin., p. 225. Seychelles.
" " ! Agass. 1836. Prod., p. 23.
" " Desml. 1837. Syn., p. 260. (pars.)
" " ! A. Agass. 1863. Bull. M. C. Z., I. p. 21. Sandwich Islands.
" *Mathaei* ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 373 (non Blainv.).

*Sandwich Islands, *Kingsmills Islands (Garrett); Zanzibar! Solomon Islands! Waigiou! Seychelles! (J. d. P.); Philippine Islands! (Semper); Nikobar! (Mus. Vienna); Mitchell's Islands! (Mus. Godeff.).

Echinometra subangularis

..... Sloane, 1725. Jam., *Pl. CCXLIV. f. 1, 2, 3.*
..... Seba, 1758. Thes., III. *Pl. X. f. 11, 16, 18; Pl. XI. f. 11.*
..... Knorr, 1771. Délic., *Pl. DI. f. 8; Pl. DIII. f. 6.*
Cidaris *variolata* ..... ! Klein, 1734. Nat. D. Ech., *Pl. III. f. C, D.*
" " ..... ! Klein, 1734. Nat. D. Ech., *Pl. IV. f. E, F.; Pl. XXX. A, B.*
? *Echinus* **lucunter** Linn. 1758. Syst. Nat., ed. X. p. 665 (non Lam.).
? " " Gmel. 1788. Linn. S. N., 3176.
Cidaris lucunter Leske, 1778. Kl. Add., p. 109, *Pl. IV. f. E, F,* copied in Enc. Méth., *Pl. CXXXIV.*
Echinometra lucunter ! Gray, 1825. Ann. Phil., p. 4.
" " ! Lütk. 1864. Bid., p. 87. W. Indies.
Cidaris **subangularis** ! Leske, 1778. Kl. Add.
" **fenestrata** Leske, 1778. Kl. Add. (pars.)
Echinometra subangularis Desml. 1837. Syn., p. 266.
Echinus **Maugei** ! Blainv. 1825. D. S. Nat. O., p. 93.
Echinometra Maugei ! Blainv. 1834. Actin., p. 225.
" " ! Agass. 1836. Prod., p. 22.
" " Desml. 1837. Syn., p. 260.
" " ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 373. (pars.)
" " ! Duj. Hupé, 1862. Échin., p. 528.
Echinus **acufer** ! Blainv. 1825. Dict. Sc. Nat. O., p. 94.
Echinometra acufera ! Blainv. 1834. Actin., p. 225 (non A. Agass.).
" " ! Agass. 1836. Prod., p. 22.
" " Desml. 1837. Syn., p. 260.
" " ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 373. (pars.)
" " ! Duj. Hupé, 1862. Éch., p. 538.
" " ! Mart. 1866. Wieg. Arch., I. p. 166.
Echinus **lobatus** ! Blainv. 1825. Dict. Sc. N. O., p. 95.
Echinometra lobata ! Blainv. 1834. Actin., p. 225.
" " ! Agass. 1836. Prod., p. 22.
" " Desml. 1837. Syn., p. 262.
" " ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 373.
" " ! Duj. Hupé, 1862. Échin., p. 539.
" **Michelini** ! Des. 1846. Agass. C. R. Ann. Sc. Nat., VI. p. 373 (non Lütk.). Yucatan.
" *Michelini* ! A. Agass. 1863. Bull. M. C. Z., I. Florida. W. Indies.
" " ! Verrill, 1867. Notes Radiata, p. 369.
" **nigrina** ! Gir. 1850. Proc. Boston Sc. N. H., p. 367. Cape Palmas.
Heliocidaris **mexicana** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 372 (non **T.** *mex.* A. Ag.).
" *mexicana* ! Duj. Hupé, 1862. Échin., p. 537.

Echinometra subangularis (*continued*).

Heliocidaris **Castelnaudi**! HUPÉ, 1858. CASTELN. Voyage Am. Sud., p. 97, Zooph., *Pl. I. f. 1.* Brazil.

" *Castelnaudi*! DUJ. HUPÉ, 1862. Échin., p. 537.

Echinometra **complanata** MICH. MS. (Écol. Min.).

*Cape Palmas (Dr. Perkins, Essex Inst.); *Cape Verde Islands (Bouvier); *Florida (Agassiz); Ascension! (J. d. P.); *Rio Janeiro (Agassiz, Thayer Exp.); *Desterro (F. Müller); *Guarapary, *Porto Seguro, *Victoria, *Campos, *Isla de Mazecas (Hartt & Copeland, Thayer Exp.); *Cuba (Arango); *Tortugas (Pourtalès, Agassiz); Abrolhos! (Hartt); *St. Thomas (Agassiz, Thayer Exp.); *Hayti (Weinland); *Charleston, S. C. (Agassiz); *Sombrero Island (Knox); *Jamaica (Adams); Bermudas (Hammond); *Aspinwall; *Nassau (Shaw); *Cumana (Anthony); *Bahamas (Bryant).

Echinometra Van Brunti

Echinometra **Van Brunti**! A. AGASS. 1863. Bull. M. C. Z., I. p. 21. Acapulco.

" *Van Brunti*! VERRILL, 1867. Notes Radiata, p. 309. San Salvador. Peru.

" " ! VERRILL, 1871. Notes Radiata, p. 585.

" **rupicola**! A. AGASS. 1863. Bull. M. C. Z., I. p. 21. Panama.

" *rupicola*! VERRILL, 1867. Notes Radiata, p. 308.

*Acapulco (A. Agassiz); *Cape St. Lucas, *Manzanillo (Xanthus, Smithson. Coll.); *La Paz (Pedersen, Yale Coll.); *Panama (A. Agassiz); *San Juan del Sur (Silliman, Yale Coll.); *Pearl Islands (Bradley, Yale Coll.); *La Union (Yale Coll.); Zorritos! Nicaragua! (Yale Coll.).

Echinometra viridis

Echinometra **viridis**! A. AGASS. 1863. Bull. M. C. Z., I. p. 22. Florida.

" *viridis*! A. AGASS. 1869. Bull. M. C. Z., I. p. 261.

" **plana**! A. AGASS. 1863. Bull. M. C. Z., I. p. 22. Hayti.

" *Michelini*! LÜTK. 1864. Bid., p. 91, *Pl. I. f. 1* (non DES. nec A. AG.). W. Indies.

*Tortugas, Fla. (Agassiz, Pourtalès); *Key Biscayne (Lyman); Cuba! (Arango); *West Indies, *Jeremie, Hayti (Weinland).

ECHINONÉUS.

Echinonëus VAN PHELS. 1774. Brief.
Echinus GMEL. 1788. Syst. Nat. (pars.)
Echinanaus GRAY, 1825. Ann. Phil.
Galerites DESML. 1837. Syn. (non AUCT.).

Echinonëus cyclostomus

..... SEBA, 1758. Thes., III. *Pl. XV. f. 30, 33, 34.*

Echinoneus **cyclostomus** LESKE, 1778. KL. Add., p. 173, *Pl. XXXVII. f. 4, 5*, copied ENC MÉTH., *Pl. CLIII. f. 19, 20.*

" *cyclostomus*! LAMK. 1816. An. s. Vert., p. 18. Asiatic Seas.

" " ! BLAINV. 1825. Dict. Sc. Nat., p. 196.

" " ! BLAINV. 1834. Actin., p. 212, *Pl. XVI. f. 5.*

" " ! AGASS. 1836. Prod., p. 187. Philippine Islands.

" " ! DESOR, 1842. AGASS. Mon. Éch. Galérites, p. 43, *Pl. VI. f. 13–15.*

" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 143.

" " ! GRAY, 1855. Cat. Rec. Echin., p. 32. Australia.

" " DESOR, 1857. Syn. Echin. foss., *Pl. XXVII. f. 1–3.*

Echinonëus cyclostomus (*continued*).

Echinoneus cyclostomus ! Duj. Hupé, 1862. Échin. p. 545.
Echinus " Gmel. 1788. Linn. Syst. Nat. 3183.
Echinanaus " ! Gray, 1825. Ann. Phil., p. 7.
Galerites **echinonea** Desml. 1837. Syn., p. 246.
Echinoneus **cruciatus** ! Agass. 1843. Des. Mon. Galérites, p. 46, *Pl. VI. f. 1–3.*
" *cruciatus* ! Gray, 1855. Cat. Rec. Echin., p. 33.
" **serialis** ! Des. 1842. Ag. Mon. Éch. Galérites, p. 48, *Pl. VI. f. 10–12.*
" *serialis* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 143.
" " ! Gray, 1855. Cat. Rec. Echin., p. 33.
" " ! Duj. Hupé, 1862. Échin., p. 545.
" **crassus** ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 143. Zanzibar.
" *crassus* ! Gray, 1855. Cat. Rec. Echin., p. 33.
" " ! Duj. Hupé, 1862. Échin., p. 546.
" " ! Mich. 1862. Maill. Bourbon Annéx. A, *Pl. XVI. f. 1.*
" **ventricosus** ! Agass. 1847. C. R. Ann. Sc. Nat., VI. p. 144. New Zealand?
" *ventricosus* ! Gray, 1855. Cat. Rec. Echin., p. 33.
" " ! Duj. Hupé, 1862. Échin., p. 546.
" *minor* ! Mart. 1866. Wieg. Arch., I. p. 169 (non Auct.). Flores. Amboina. Manila.

*Australia; *Bourbon (J. d. P.); *Kingsmills Islands (Garrett); Zanzibar! (J. d. P.); Flores, Amboina, Manila (Martens); Lord Hood's Islands! (Brit. Mus.).

Echinonëus semilunaris

..... Seba, 1758. Thes., III. *Pl. X. f. 7*, copied in Leske, *Pl. XLIX. f. 8, 9*, et Enc. Méth. *Pl. CLIII. f. 21, 22.*
..... Knorr, 1771. Délic., *Pl. DI. f. 11.*
Echinoneus **minor** Leske, 1778. Kl. Add., p. 174, *Pl. XLIX. f. 8, 9.*
" *minor* ! Blainv. 1834. Actin., p. 212.
" " ! Desor, 1842. Agass. Mon. Éch. Galérites, *Pl. VI. f. 16.*
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII., p. 143.
" " ! Gray, 1855. Cat. Rec. Echin., p. 32.
" " ! Duj. Hupé, 1862. Échin., p. 545.
Echinus **ovalis** Linn. 1753. Mus. Tess., p. 114.
" **semilunaris** Gmel. 1788. Linn. Syst. Nat.
Echinoneus semilunaris ! Lamk. A. 1816. An. s. Vert., p. 19. St. Domingo. W. Indies.
" " ! Blainv. 1825. Dict. Sc. Nat, XIV. p. 196.
" " ! Blainv. 1834. Actin., p. 212.
" " ! Agass. 1836. Prod., p. 20.
" " ! Desml. 1837. Syn., p. 340.
" " ! Edw. in Cuv. Règ. An. ed. Ill., *Pl. XIV. f. 1.*
" " ! Lütk. 1864. Bid., p. 124. W. Indies.
" " ! A. Agass. 1869. Bull. M. C. Z., I. p. 267. Straits Florida.
" **gibbosus** ! Lamk. 1816. An. s. Vert., p. 19. American Seas.
" *gibbosus* ! Blainv. 1825. Dict. S. N., XIV. p. 196.
" " ! Agass. 1836. Prod., p. 20.
" " Desml. 1837. Syn., p. 340.
" " ! Des. 1842. Ag. Mon. Éch. Galérites, p. 46, *Pl. VI. f. 4–6.*
" " ! Gray, 1855. Cat. Rec. Ech., p. 32.
" **elegans** ! Desor, 1842. Ag. Mon. Éch. Galérites, p. 47, *Pl. VI. f. 7–9.* Hayti.
" *elegans* ! A. Agass. 1863. Bull. M. C. Z., I. Florida.
" **conformis** ! Des. 1842. Mon. Gal., p. 48, *Pl. VI. f. 17–21.*
" *conformis* Bronn, 1859. Kl. u. Ord. Actin., *Pl. XLII. f. 2.*

*Jamaica, *St. Thomas (Adams); Jeremie, Hayti (Weinland); *Cuba; *Bermuda (Hammond); *Carysfort Reef (Pourtalès); Guadeloupe! (Brit. Mus.); Cuba! Arango; Porto Rico! (Mus. Copenh.).

ECHINOSTREPHUS.

Echinometra ..... RUMPH. 1705. Amb. Rar. Kam.
Echinus BLAINV. 1825. Dict. Sc. Nat. (pars.)
Psammechinus DUJ. HUPÉ, 1862. Échin. (pars.)
Echinostrephus A. AGASS. 1863. Bull. M. C. Z., I.

Echinostrephus molare

Echinometra **setosa** RUMPH. 1705. Amb. Rar. Kam., *Pl. XIII. f. 5.*
..... SEBA, 1758. Thes., III. *Pl. XIII. f. 9.*
Echinus **molaris** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 88.
" *molaris* DESML. 1837. Syn., p. 282.
" **mola** ! BLAINV. 1834. Actin., p. 228.
" **laganoides** ! DES. 1846. AGASS. C. R. Ann. Sc. Nat., VI. p. 370.
Psammechinus laganoides ! DUJ. HUPÉ, 1862. Échin., p. 528.
" " ! PERRIER, 1869. Pédic., p. 151.
Echinus **lexaroides** PERRIER, 1869. Pédic., p. 146.
" **longispina** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 89.
" *longispinus* ! BLAINV. 1834. Actin., p. 228.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 370.
" " ! PERRIER, 1869. Pédic., p. 146.
" *longispina* DESML. 1837. Syn., p. 282.
Psammechinus longispinus DUJ. HUPÉ, 1862. Échin., p. 527.
" " PERRIER, 1869. Pédic., p. 151.
Echinostrephus aciculatus ! A. AGASS. 1863. Bull. M. C. Z., I. p. 21. Kingsmills Islands. Sandwich Islands.
Perinatus *laganoides* DES. MS. (J. d. P.).

*Kingsmills Islands, *Sandwich Islands, *Society Islands (Garrett); *Zanzibar (Cooke); Mozambique! (Mus. Stock.); Natal! (Mus. Stutt.); Bourbon! (J. d. P.); Cape Good Hope (Brit. Mus.); Amboina (Rumph.).

ECHINOTHRIX.

Echinometra ..... RUMPH. 1705. Amb. Rar. Kam.
Diadema SCHYNV. 1711. Thes. Imag.
Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Echinus GMEL. 1788. LINN. Syst. Nat. (pars.)
Cidarites LAMK. 1816. An. s. Vert. (pars.)
Astropyga AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Echinothrix PETERS, 1853. Monatsb. Akad. Berlin.
Echinothrix BÖLSCHE, 1865. Wieg. Archiv.
" A. AGASS. 1863. Bull. M. C. Z., I.
Savignya DES. 1854. Syn. Ech. foss.
Garelia GRAY, 1855. Proc. Zoöl. Soc. Lond.
Garelia A. AGASS. 1863. Bull. M. C. Z.

Echinothrix calamaris

Echinus **calamaris** PALL. 1774. Spic. Zool., I. fas. X. *Pl. II. f. 4–8*, copied in DESLONG. Enc. Méth., *Pl. CXXXIV. f. 9–11.*
Cidaris calamaris LESKE, 1778. Kl. Ech., p. 115, *Pl. XLV. f. 1–4.*
Echinus calamarius GMEL. 1788. LINN. Syst. Nat., 3173.

Echinothrix calamaris (*continued*).

Cidarites **calamaria** ! Lamk. 1816. A. s. Vert., p. 58. (pars.)
Diadema calamaria ! Gray, 1825. Ann. Phil., p. 4.
" *calamarium* ! Agass. 1836. Prod., p. 22.
" " Desml. 1837. Syn., p. 308.
" " ! Mich. 1845. Rev. Mag. Zoöl., p. 14.
" " ! Duj. Hupé, 1862. Échin., p. 505. (pars.)
" *calamare* ! Mart. 1866. Wieg. Arch., p. 150. (pars.) Timor.
Cidaris calamaria ! Blainv. 1834. Actin., p. 231.
Astropyga calamaria ! Agass. 1846. C. R. Ann. Sc. Nat, VI. p. 345. Amboina.
Echinothrix *calamaria* Peters, 1853. Monatsb. Berl. Ak., p. 484. Mozambique.
Echinothrix " ! Peters, 1854. Seeig. v. Moss., p. 116.
" " ! Peters, 1854. Seeig. v. Moss., p. 116.
Garelia aequalis ! Gray, 1855. Proc. Zoöl. Soc. Lond., p. 38. Mauritius.
Echinothrix aequalis ! Bölsche, 1865. Wieg. Arch., I. p. 333.
" **aperta** ! A. Agass. 1863. Bull. M. C. Z., p. 19. Society Islands.
" *aperta* ! Bölsche, 1865. Wieg. Arch., I. p. 333.
" *turcarum* ! Bölsche, 1865. Wieg. Arch., I. p. 330. (pars)

*Society Islands (Garrett); *Kupang, Timor (Martens, Mus. Berlin); Amboina! Nikobar! (Mus. Copenh.); Pomotu Islands! (U. S. Ex. Exp., Smithson. Coll.); Wupang! (Berlin Mus.); Philippine Islands! (Semper); Sandwich Islands! (Vienna Mus.).

Echinothrix Desorii

Cidarites **calamaria** ! Lamk. 1816. An. s. Vert., p. 58. (pars.) Mers d'Indes.
Diadema calamarium ! Duj. Hupé, 1862. Échin., p. 505. (pars.)
" " ! Perrier, 1869. Pédic, p. 316, *Pl. IV. f. 3, 3b.*
Astropyga **Desorii** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 345. Red Sea.
Echinothrix *Desorii* Peters, 1853. Monatsb. Berl. Ak., p. 484.
Echinothrix " ! Peters, 1854. Seeig. v. Moss., p. 117.
" " ! Bölsche, 1865. Wieg. Archiv, p. 330.
" **scutata** ! A. Agass. 1863. Bull. M. C. Z., I. p. 19. Sandwich Islands.
" *scutata* ! Bölsche, 1865. Wieg. Arch., I. p. 333.
Echinothrix annellata ! Peters, 1853. Monatsb. Ak. Berl., p. 484. Mozambique.
Echinothrix annellata Peters, 1854. Seeig. v. Moss., p. 117.
" " Bölsche, 1865. Wieg. Archiv, I. p. 333.
Garelia clavata ! Gray, 1855. Proc. Zoöl. Soc. London, p. 38.
Savignya **Frappieri** Mich. 1862. Maill. An. A., *Pl. XV. f. 1–9.* Bourbon.
Echinothrix clavata Bölsche, 1865. Wieg. Archiv, I. p. 333.

*Sandwich Islands (Garrett); *Feejee Islands (Mus. Godeff.); *Mauritius (Pike); Bourbon! (Écol. Min.); *Red Sea (J. d. P., Botta).

Echinothrix turcarum

Echinometra ..... Rumph. 1705. Amboin. Rar. Kam., *Pl. XIV. f. B.*
Diadema turcarum Schynv. 1711? Thes. Imag., p. 2 (teste Bölsche).
Diadema turcarum ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 349. (pars.)
Echinothrix *turcarum* Peters, 1853. Monatsb. Berl., p. 484.
Echinothrix " ! Peters, 1854. Seeig. v. Moss, p. 116. Mozambique.
" " ! Bölsche, 1865. Wieg. Arch., I. p. 330. (pars.)
" " ! Bölsche, 1866. Wieg. Arch., I p. 89.
Garelia " ! A. Agass. 1863. Bull. M. C. Z., I. p. 19.
Echinus **diadema** Linn. 1758. Syst. Nat.
Cidaris **araneiformis** Leske, 1778. Kl. Ech., p. 116.
Echinus araneiformis Gmel. 1788. Linn. Syst. Nat., 3173.
" **coronalis** Leske, 1778. Kl. Ech., p. 116.
Cidarites **spinosissima** ! Lamk. 1816. An. s. Vert., p. 58.
Diadema spinosissimum ! Agass. 1836. Prod., p. 22.
" " Desml. 1837. Syn., p. 308.

Echinothrix turcarum (*continued*).

Diadema spinosissimum ! MICH. 1845. Rev. Mag. Zoöl., p. 13. Isle de France.
" " ! MART. 1866. Wieg. Arch., p. 152.
Astropyga spinosissima ! AGASS. 1846. C. R. Ann. Sc. Nat., VI p. 345. Mauritius. Zanzibar.
Echinothrix " PETERS, 1853. Monatsb. Berl., p. 484.
Echinothrix " ! PETERS, 1854. Seeig. v. Mos., p. 117.
" " ! BÖLSCHE, 1865. Wieg. Arch., I. p. 330.
Savignya " ! DUJ. HUPÉ, 1862. Échin., p. 506.
" " ! PERRIER, 1869. Pédic., p. 137, *Pl. IV. f. 6.*
Cidarites **subularis** ! LAMK. 1816. An. s. Vert., p. 58. Isle de France.
Diadema subulare ! AGASS. 1836. Prod., p. 22.
" " DESML. 1837. Syn., p. 308.
Astropyga subularis ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 345. Seychelles.
Echinothrix " PETERS, 1853. Monatsb. Berl. Ak., p. 484.
Echinothrix " ! PETERS, 1854. Seeig. v. Moss., p. 117.
" " ! BÖLSCHE, 1865. Wieg. Arch., I. p. 329.
Savignya " ! DES. 1854. Syn. Éch. foss.
Savignya " ! DUJ. HUPÉ, 1862. Échin., p. 505.
Garelia " ! A. AGASS. 1863. Bull. M. C. Z., p. 18.
Diadema **Desjardinsii** ! MICH. 1844. Rev. Mag., p. 136. Isle de France.
" *Desjardinsii* ! MICH. 1845. Rev. Mag., p. 14, *Pl. VII.*
Garelia **cincta** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 18. Kingsmills Islands. Sandwich Islands.
Echinothrix cincta ! BÖLSCHE, 1865. Wieg. Arch., I. p. 333.
" **Petersii** ! BÖLSCHE, 1865. Wieg. Arch., I. p. 334, *Pl. XIII.* Feejee Islands.

*Sandwich Islands, *Society Islands, *Kingsmills Islands (Garrett); *Feejee Islands, Bonin Islands! (W. Stimpson, Smithson. Coll.); Samoa! Upolu! (Mus. Godeff.); Amboina (Rumph); Timor (Mus. Berl.); *Zanzibar (Cheney); *Mauritius (Pike); New Ireland! Red Sea! Mauritius! Isle de France! (J. d. P.); Philippine Islands! (Semper).

ECHINUS.

Echinus RONDEL. 1554. De Pisc. Mar.
Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Echinus LINN. 1758. Syst. Nat. (pars.)
Heliocidaris AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Psammechinus AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Sphaerechinus DUJ. HUPÉ, 1862. Échin (pars.)

Echinus acutus

? *Cidaris* **Basteri** LESKE, 1778. KL. Add. p. 23, *Pl. XLIX. f. 2.*
Echinus **acutus** ! LAMK. 1816. An. s. Vert., p. 45.
" *acutus* ! BLAINV. 1825. Dict. Sc. N. O., p. 78.
" " ! BLAINV. 1834. Actin., p. 227.
" " DESML. 1837. Syn., p. 270.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 365.
" " ARADAS, 1853. Monog. Ech. Atti. Catania, VIII. p. 276. Sicily.
" " CAILL. 1865. Cat. Rad. Ann., p. 20.
" *miliaris* FLEM. 1828. Brit. An., p. 478 (non AUCT.).
" **Flemingii** !? BALL. 1841, in FORBES, Brit. Starf., p. 164, fig.
" *Flemingii* ! DÜB. o. KOR. 1844. Skand. Ech., p. 266, *Pl. IX. f. 31, 32.* Norway.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 365.
" " ! GRAY, 1848. Brit. Rad., p. 3.

Echinus acutus (*continued*).

Echinus Flemingii SARS, 1857. Middelh. Litt. Faun., p. 111. Naples.
" " ! SARS, 1861. Norges Ech., p. 93.
" " ! DUJ. HUPÉ, 1862. Éch., p. 525.
" " ! GRUBE, 1864. Insel Lussin. Lussin (Adriatic).
" *sardicus* CAILL. 1865. Cat. Rad. An., p. 20 (non AUCT.). W. coast France.

*Devonshire, *W. coast Norway (Sars); *Oban, *Milford (W. Stimpson); *Mosterhavn, *Hardangerfjord (G. O. Sars); *Shetland Islands, 150 fms., *between Faroe and Shetland Islands, 400 fms., *So. Ireland, 100 fms., *Cape de Gatte, *Cape Sagras, 165 fms. (Porcup. Exped.); *Naples (Panceri); Katwijck (Maitland); Lussin (Grube); Lessina (Heller); Port Vendres! Oran! Algeria! (J. d. P.).

Echinus angulosus

Cidaris *miliaris angulosa* ! KLEIN, 1734. Nat. Disp. Ech., *Pl. III. f. A, B.*
Cidaris **angulosa** LESKE, 1778. KL. Add., *Pl. III. f. A, B*, copied in ENC. MÉTH., *Pl. CXXXIII. f. 5, 6.*
..... GUALTERI, 1742. Index Test., *Pl. CVIII. f. A*, copied in ENC. MÉTH., *Pl. CXCVIII.*
..... SEBA, 1758. Thes., III. *Pl. X. f. 20.*
..... KNORR, 1771. Délic., *Pl. D. f. 4, 5.*
..... AUDOUIN in SAVIGNY, Égypte, *Pl. VII. f. 2.*
Echinus **subangulosus** ! LAMK. 1816. An. s. Vert., p. 48 (non BLAINV.).
" *subangulosus* DESML. 1837. Syn., p. 270. Cape Good Hope.
Psammechinus *subangulosus* ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 368.
Psammechinus " ! DUJ. HUPÉ, 1862. Échin., p. 527.
" **verruculatus** LÜTK. 1864. Bid, p. 166.
Echinus **minimus** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 80. Cape Good Hope.
" *minimus* DESML. 1837. Syn., p. 274.
" *minutus* ! BLAINV. 1834. Actin., p. 227.

*Cape Good Hope (Wahlenberg); *Simon's Bay (W. Stimpson); *Cape Town (Layard); *Nikobar (Mus. Vienna); Butu (Bonn Mus.); Mauritius! (Stockholm); Mozambique (Bianconi); *New Zealand (Edwards); Adelaide! E. coast Australia! (Brit. Mus.); *Red Sea (Hemp. u. Ehreb. Mus. Berl.); Suez! (J. d. P.); Philippine Islands! (Semper).

Echinus elegans

Echinus elegans ! (**Düb. o. Kor.**) 1844. Skand. Echin., p. 272, *Pl. X. f. 40–42.* W. coast Norway.
" " AGASS. 1846. Ann. Sc. Nat., VI. p. 365.
" " ! SARS, 1861. Norges Echin., p. 94.
" " DUJ. HUPÉ, 1862. Échin., p. 524.

*Hardangerfjord, 150 fms. (G. O. Sars); *Cape Sagras, 80 fms., *between Faroe and Shetland Islands, 400 fms., *off Valencia, 90 fms. (Porcup. Exped.); W. coast Norway, 250 fms. (Danielsen); Bergen (Sars).

Echinus esculentus

Cidaris *miliaris* sp. II. *hemisphaerica* KLEIN, 1734. *Pl. II. f. E.*
..... KNORR, 1771. Délic., *Pl. D. f. 1; Pl. DII. f. 12*, copied in LESKE, KL. Add., *Pl. XXXVIII. f. 1.*
Echinus **subglobosus** LINN. 1745. Faun. Suec., p. 513.
" *esculentus* LINN. 1758. Syst. Nat, ed. X. p. 663 (non RUMPH nec LESKE).
" " ! GRAY, 1825. Ann. Phil., p. 4.
" " FLEM. 1828. Brit. An., p. 478.
" " ! AGASS. 1836. Prod, p. 190.
" " DESML. 1837. Syn., p. 278.
" " ! DÜB. o. KOR. 1844. Skand. Ech., p. 264. W. coast Norway.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 365. German Ocean.
" " GRAY, 1848. Brit. Rad., p. 3.
" " ! SARS, 1861. Norges Ech., p. 93.

Echinus esculentus (*continued*).

Sphaerechinus esculentus Duj. Hupé, 1862. Échin., p. 529.
" " Perrier, 1869. Pédic., p. 151, *Pl. V. f. 8 a–c.*
Cidaris **hemisphaerica** Leske, 1778. Kl. Add., p. 126.
Echinus **sphaera** !? Müll. 1776. Prod. Zool. Dan., p. 235.
" *sphaera* Penn. 1812. Brit. An., 2d ed., *Pl. XXXVI. f. 1;* 1st ed., *Pl. XXXIV. f. 1.*
" " Forbes, 1841. Brit. Starf., p. 149, fig.
" " Val. 1841. Agass. Mon. Éch., Anat. Ech., *Pl. VII.–IX.* passim.
" " Müll. 1848. Abhdl., I. *Pl. V. f. 1–8; Pl. VI., VII. f. 1–3* (Pluteus).
" " Müll. 1854. Bau d. Ech., *Pl. II. f. 1.*
" " Gosse, 1856. Tenby, fig.
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 8.*
" " Stewart, 1865. Trans. Linn. Soc., XXV. *Pl. L. f. 2 a.*
" **globiformis** ! Lamk. 1816. An. s. Vert., p. 44.
" *globiformis* ! Blainv. 1825. Dict. Sc. Nat. O., p. 79.
" " Blainv. 1834. Actin., p. 227.
" " Desml. 1837. Syn., p. 270.
" " Caill. 1865. Cat. Rad. An., p. 20.
" **subangulosus** ! Blainv. 1825. Dict. Sc. N. O., p. 78 (non Lamk.).
" *subangulosus* Blainv. 1834. Actin., p. 227.
" **pseudomelo** ! Blainv. 1825. Dict. Sc. N. O., p. 77.
" *pseudomelo* Blainv. 1834. Actin., p. 227.
" " Desml. 1837. Syn., p. 270.
" **aurantiacus** ! Blainv. 1825. Dict. S. N. O., p. 79.
" *aurantiacus* Blainv. 1834. Actin., p. 227.
" " Desml. 1837. Syn., p. 272.
" **quinqueangulatus** ! Blainv. 1825. Dict. Sc. N. O., p. 79.
" *quinqueangulatus* Desml. 1837. Syn., p. 270.
" **quinqueangulosus** Blainv. 1834. Actin., p. 227.
" **violaceus** ! Blainv. 1825. Dict. Sc. N. O., p. 80.
" *violaceus* ! Blainv. 1834. Actin., p. 227.
" " Desml. 1837. Syn., p. 272.
" *depressus* ! Mich. MS. (Écol. Min.).

*W. Sweden, *Norway (Sars); *Lofoten Islands, l. w. m. — 80 fms. (G. O. Sars); *Oban (W. Stimpson); *Heligoland (Weinland); *Milford, *W. coast Great Britain, *Oban (W. Stimpson); English Channel, Scotland (Forbes); Finmark (Sars); Drontheim — Cape North, l. w. m. — 15 fms. (McAndrew & Barrett); Ireland! (Mus. Copenh.); Schveningen, Katwijck, Groningen (Maitland).

Echinus gracilis

Echinus **gracilis** ! A. Agass. 1869. Bull. M. C. Z., I. p. 269. Straits Florida.

*Off Sand Key, 120, 125 fms., *Florida Gulf Stream, 101, 119, 128, 150, 200 fms., *Key West, 135, 140 fms., *off Tennessee Reef, 114 fms., *off Alligator Reef, 156 fms. (Pourtalès); St. Thomas! (Duchassaing, J. d. P.).

Echinus magellanicus

Echinus **magellanicus** ! Phil. 1857. Wieg. Archiv, I. 130. Straits of Magellan.
Psammechinus magellanicus ! Duj. Hupé, 1862. Échin., p. 528.
" **cupreus** ! Trosch. MS. Mus. Frankfort.

*Patagonia (Denning); *Straits Magellan (Mus. Stockh., Mack); *Valparaiso (Loriol); *New Zealand, Australia! (Frankfort Mus.).

Echinus margaritaceus

Echinus **margaritaceus** ! LAMK. 1816. An. s. Vert., p. 47. So. Pacific ?
" *margaritaceus* ! BLAINV. 1825. Dict. Sc. Nat., p. 78.
" " ! BLAINV. 1834. Actin., p. 227.
" " DESML. 1837. Syn., p. 270.
" " ! VAL. 1846. Voyage Vénus, Zooph., *Pl. VI. f. 1.*
Heliocidaris margaritacea ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 371. So. Pacific.
" " ! DUJ. HUPÉ, 1862. Échin., p. 537.

*Cape Horn (Mus. Godeff.); So. Polar seas ! (J. d. P.); New Zealand ! (Smithson. Coll.); Port Otway, W. coast Patagonia ! (Brit. Mus.).

Echinus melo

Echinometra ..... RONDEL. 1554. Lib. de Pisc. Mar., p. 578.
..... GUALTERI, 1742. *Pl. CVI. f. E.*
?..... ENC. MÉTH. *Pl. CXLI. f. 1, 2.*
Echinus **melo** ! LAMK. 1816. An. s. Vert., p. 45. Mediterranean.
" *melo* RISSO, 1826. Europ. Mér., V. p. 276.
" " ! BLAINV. 1827. Dict. Sc. N. O., p. 77.
" " ! BLAINV. 1834. Actin., p. 226, *Pl. XX. f. 3.*
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn., p. 276.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 365. Algeria.
" " MÜLL. Abhdl., IV. *Pl. VII. f. 9*, (Pluteus).
" " ARADAS, 1853. Monog. Echin. Atti. Gioen., VIII. p. 275. Sicily.
" " SARS, 1857. Middelh. Litt. Fauna, p. 111. Naples.
" " ! DUJ. HUPÉ, 1862. Échin., p. 524.
" " ! GRUBE, 1864. Insel Lussin. Lussin (Adriatic).
" " CAILL. 1865. Cat. Rad. Ann., p. 19. W. coast France.

*Nice (Burkhardt, Verany); *Naples (Panceri); *W. coast Italy (Rigacci); *Venice (Lyman): Mediterranean ! Oran ! Alger ! Cape Verde Islands ! (Bouvier); W. coast Africa ! Canary Islands ! Spain ! Portugal ! (J. d. P.); Dalmatia (Müll.); Quarnero, Lussin (Grube); Lessina, 35–55 fms. (Heller).

Echinus microtuberculatus

..... KNORR, 1771. Délic., *Pl. D. f. 6.*
Echinus **microtuberculatus** ! BLAINV. 1825. Dict. Sc. N. O., p. 88. Mediterranean.
Psammechinus *micrctuberculatus* ! AGASS. 1846. C. R. Ann. Sc. Nat., VII. p. 366.
Psammechinus " ! SARS, 1857. Middelh. Lit. Fauna, p. 115.
" " ! DUJ. HUPÉ, 1862. Échin., p. 526.
" " PERRIER, 1869. Pédic, p. 150, *Pl. V. f. 3 a, b.*
Echinus **parvituberculatus** ! BLAINV. 1834. Actin., p. 228.
" *parvituberculatus* DESML. 1837. Syn., p. 282.
Psammechinus parvituberculatus ! LÜTK. 1864. Bid., p. 168.
Echinus miliaris RISSO, 1820. Europ. Mérid., V. (non MÜLL. nec LINN.).
" " ARADAS, 1853. Monog. Echin. Atti. Gioen., VIII. p. 290. Sicily.
" **pulchellus** ! AGASS. 1841. VAL. Anat. gen. Ech., p. VI.
" *pulchellus* MÜLL. 1854. Abhdl., IV. p. 48, *Pl. VI. f. 1–6* (Pluteus).
" " MÜLL. 1856. Bau d. Ech., *Pl. II. f. 4.*
Psammechinus pulchellus BRONN, 1859. Kl. u. Ord., p 338, Actin., *Pl. XXXIX. f. 5.*
" " DUJ. HUPÉ, 1862. Échin., p. 526.
Echinus **decoratus** ! AGASS. 1841. VAL. Anat. g. Ech., p. VII.
Psammechinus decoratus ! DUJ. HUPÉ, 1862. Échin., p. 527.

*Mediterranean, *Spezzia (Lyman); *Naples (Panceri); *W. coast Italy (Rigacci); Triest (Müller); Lissa, Lessina, Ragusa (Heller); Cape Verde Islands ! (J. d. P.); Genoa, Nice (Verany); Messina (Sars).

Echinus miliaris

Cidaris *miliaris saxatilis* KLEIN, 1734. Nat. Disp. Ech., *Pl. II. f. A, B; Pl. XXXI. f. C.*
Echinus **miliaris** MÜLL. 1771. KNORR, Del.
" *miliaris* ! LAMK. 1816. A. s. Vert, p. 49. N. European Atlantic.
" " ! BLAINV. 1825. Dict. Sc. N. O., p. 80 (non FLEM).
" " BLAINV. 1834. Actin., p. 237.
" " DESML. 1837. Syn., p. 272.
" " ! AGASS. 1841. VAL. Anat. gen. Ech., p. VI.
" " ! FORBES, 1841. Brit. Starf., p. 161, fig.
" " ! Gray, 1848. Brit. Rad., p. 3.
" " SARS, 1861. Norges Ech., p. 94.
Psammechinus *miliaris* ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 368.
Psammechinus " ! DESOR, 1855. Syn. Ech. foss., *Pl. XVIII. f. 7, 8.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 526.
" " ! PERRIER, 1869. Pédic., p. 146, *Pl. V. f. 1 a–d.*
Echinus saxatilis O. F. MÜLL. 1776. Prod., p. 235 (non LINN. nec FAB.).
Cidaris " LESKE, 1778. KL. Add., p. 82, *Pl. II. f. A, B; Pl. XXXVIII. f. 2, 3*, copied in Enc. Méth., *Pl. CXXXIII. f. 1, 2.*
Echinus **pustulatus** ! AGASS. 1841. VAL. An. gen. Ech., p. VI.
Psammechinus pustulatus ! DUJ. HUPÉ, 1862 Échin. p. 527.
Echinus **virens** ! DÜB. o. KOR. 1844. Skand. Ech., p. 274, *Pl. X. f. 43, 44.* W. coast Norway.
Psammechinus Koreni DES. 1846. AGASS. C. R. Ann. Sc. Nat., VI. p. 368.
? GOSSE, 1856. Tenby, Pluteus, fig.

*Norway, *Oresund (Mus. Copenh.); *Dröback (Eschricht); *Boulogne; *Oban (W. Stimpson); English Channel! Liverpool! Milford! (Liverpool Mus.); S. W. coast Sweden (Sars); Ireland (Thomson); Drontheim — Cape North (McAndrew & Barrett); W. Scotland, N. Ireland, Guernsey (Forbes); Schveningen, Katwijck, Doneburg (Maitland).

Echinus norvegicus

Echinus **norvegicus** ! DÜB. o. KOR. 1844. Skand. Echin., p. 268, *Pl. IX. f. 33–39.* W. coast Norway.
" *norvegicus* ! SARS, 1861. Norges Echin., p. 94.
Psammechinus *norvegicus* ! AGASS. DES. 1846. C. R. Ann. Sc. Nat., VI. p. 368.
Psammechinus " ! DUJ. HUPÉ, 1862. Échin., p. 526.
Echinus Flemingii ! A. AGASS. 1869. Bull. M. C. Z, I. p. 262 (non AUCT.). Straits Florida.
" *depressus* G. O. SARS, 1871. Vidensk. Selsk. Forh., p. 23 (non BLAINV.). Lofoten.
" **rarispinus** ! G. O. SARS, 1871. MS. Lofoten.

*North Sea, 200 fms. (Mus. Stock.); *Lofoten Islands, 200–300 fms., Storggen Bank, 80–100 fms. (G. O. Sars); *Shetland Islands, *off Valencia, *between Faroe and Shetland Islands, 400 fms. *Cape Wrath, 300 fms., *Adventure Bank (Porcupine Exped.); W. coast Norway, 450 fms. (Danielsen); *Florida Gulf Stream, 195 fms. (Pourtalès); Salterfjord 150–200 fms. (G. O. Sars).

ENCOPE.

Echinodiscus LESKE, 1778. KL. Add. (pars.)
Echinus GMEL. 1788. Syst. Nat. (pars.)
Scutella LAMK. 1816. An. s. Vert. (pars.)
Encope AGASS. 1840. Cat. Syst. Ectyp.
Encope AGASS. 1841. Monog. Scut.
Echinoglycus GRAY, 1855. Cat. Rec. Ech. (pars.)
Mellita AGASS. 1841. Monog. Scut. (pars.)
Moulinia AGASS. 1841. Monog. Scut.
Moulinsia AGASS. 1847. C. R. Ann. Sc. Nat., VII. (non GRATEL, 1840).

Encope californica

Encope **californica** ! VERRILL, 1870. Sill. Journ., p. 97. La Paz.
" *californica* ! VERRILL, 1871. Notes Radiata, p. 586, *Pl. X. f. 5, 6.* Cape St. Lucas.

*La Paz (Pedersen, Yale Coll.).

Encope emarginata

..... SEBA, 1758. Thes., III. *Pl. XV. f. 5, 6*, copied in Enc. Méth., *Pl. CXLVIII.*
Echinodiscus **emarginatus** LESKE, 1778. KL. Add., p. 136, *Pl. L. f. 5, 6*, copied in Enc. Méth., *Pl. CL. f. 1, 2.*
Echinus emarginatus GMEL. 1788. LINN. Syst. N., 3189.
Scutella *emarginata* ! LAMK. 1816. An. s. Vert., p. 9.
Scutella " ! BLAINV. 1825. Dict. Sc. N. Scut., p. 224.
" " ! BLAINV. 1834. Actin., p. 219.
" " ! AGASS. 1836. Prod., p. 188.
" " DESML. 1837. Syn., p. 222.
Encope " ! AGASS. 1841. Mon. Scut., p. 47, *Pl. X.*
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 137. Rio Janeiro.
" " ! DUJ. HUPÉ, 1862. Échin., p. 567.
" " ! LÜTK. 1864. Bid., p. 111, *Pl. II. f. 4, 5.* W. Indies.
" " ! VERRILL, 1868. Notes Radiata, p. 370. Rio, Bahia.
" " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 267, 289. Straits Florida.
Echinodiscus **quaterperforatus** LESKE, 1778. KL. Add., p. 140.
Echinus **tetraporus** GMEL. 1788. LINN. Syst. N., 3189.
Scutella tetrapora BLAINV. 1834. Actin., p. 219, *Pl. XVIII. f. 4.*
Scutella quadrifora LAMK. 1816. An. s. Vert., p. 9.
Scutella quadrifora BLAINV. 1825. Dict. Sc. Nat. Scut., p. 224.
" " DESML. 1837. Syn., p. 224.
" **quinqueloba** ESCH. 1829. Zool. Atl., *Pl. XX. f. 1.* Rio Janeiro.
Encope quinqueloba ! GRUBE, 1857. Nov. Act., XXVII. p. 46.
Scutella **cassidulina** DESML. 1837. Syn., p. 232. Martinique.
Moulinia *cassidulina* ! AGASS. 1841. Mon. Scut., p. 139, *Pl. XXII. f. 1–6.*
Moulinsia " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 139.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 27.
" " ! DESOR, 1857. Synops. Ech. foss., *Pl. XXVII. f. 14–16.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 558.
" " ! LUTK. 1864. Bid., p. 118.
Encope **Valenciennesii** ! AGASS. 1841. Mon. Scut., p. 54, *Pl. VII., VIII.* Martinique.
" *Valenciennesii* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! DUJ. HUPÉ, 1862. Échin., p. 569.
" **subclausa** ! AGASS. 1841. Mon. Scut., p. 56, *Pl. V. f. 5.* Brazil.
" *subclausa* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 137.

Encope emarginata (*continued*).

Encope subclausa ! Duj. Hupé, 1862. Échin., p. 569.
" **oblonga** ! Agass. 1841. Mon. Scut., p. 53, *Pl. IX.* Rio Janeiro.
" *oblonga* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! Duj. Hupé, 1862. Échin., p. 569.
Mellita **lobata** ! Agass. 1841. Mon. Scut., p. 44, *Pl. IV a. f. 13.*
" *lobata* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 139.
" " ! Mich. 1858. Rev. Mag. Zoöl., No. 8.
" " ! Duj. Hupé, 1862. Échin., p. 567.
" **nummularia** ! Val. 1847. Agass. C. R. Ann. Sc. Nat., VII. p. 139.
" *nummularia* ! Gray, 1855. Cat. Rec. Ech., p. 24.
" " ! Duj. Hupé, 1862. Échin.
Encope **Ghiesbrechtii** Belval, 1863. Bull. Acad. Brux., XV. p. 419.
Echinoglycus frondosus ! Gray, 1855. Cat. Rec. Ech., p 24. Nicaragua.

*Desterro, Brazil (F. Müller); *Rio Janeiro, *Maranhao (Agassiz, Thayer Exp.); *Victoria, *Sta. Anna Island (Hartt & Copeland, Thayer Exped.); *West Indies; *Cumana, Venez. (Couthouy); Bahia, Itapaji, Purpui, San Antonio (Hartt); *Florida Gulf Stream, 7 fms. (Pourtalès); Martinique ! (Mus. Neuftl., Brit. Mus.); Nicaragua ! Yucatan ! (Brit. Mus.); Pernambuco (Belval); Charleston, S. C. ! (Gibbes).

Encope grandis

Encope grandis ! Agass. 1840. Cat. Syst. Ectyp.
Encope grandis ! Agass. 1841. Mon. Scut., p. 57, *Pl. VI.*
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! Duj. Hupé, 1862. Échin., p. 569.
" " ! A. Agass. 1863. Bull. M. C. Z., I. p. 26. Gulf California.
" " ! Verrill, 1867. Notes Radiata, p. 310. La Paz.
" " ! Verrill, 1871. Notes Radiata, p. 585.
Echinoglycus *grandis* ! Gray, 1855. Cat. Rec. Ech., p. 26.
Encope **Agassizii** ! Mich. 1851. Rev. Mag. Zoöl., No. 2.
" *Agassizii* ! Duj. Hupé, 1862. Échin., p. 569.

*Lower California (Caldwell, Stone); *Guaymas (Stone); *La Paz (Pedersen, Yale Coll.).

Encope Michelini

Encope **Michelini** ! Agass. 1841. Mon. Scut., p. 58, *Pl. VI a. f. 9, 10.* Yucatan.
" *Michelini* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! Duj. Hupé, 1862. Échin., p. 569.
" " A. Agass. 1863. Bull. M. C. Z., I. p. 27. Tampa Bay.
" " A. Agass. 1869. Bull. M. C. Z., I., p. 266. Straits Florida.
Echinoglycus frondosus ! Gray, 1855. Cat. Rec. Ech., p. 25, Var. 5.
Encope **aberrans** ! Mart. 1867. Wieg. Arch., I. p. 112. Campiche Bay.

*Yucatan; *Tampa Bay, Fla., *Captiva Key, Fla. (Würdemann); *off Sarrasota Bay, 5 – 6 fms. *Rebecca Shoals (Pourtalès); *Alabama; Campiche Bay ! (Mus. Berl.).

Encope micropora

Encope **micropora** ! Agass. 1841. Mon. Scut., p. 50, *Pl. X a. f. 4–8; Pl. XIX a. f. 7.*
" *micropora* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! Duj. Hupé, 1862. Échin., p. 568.
Encope **cyclopora** ! Agass. 1841. Mon. Scut., p. 52, *Pl. X b. f. 6–9.*
" *cyclopora* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! Duj. Hupé, 1862. Échin., p. 568.
Echinoglycus *cyclopora* ! Gray, 1855. Cat. Rec. Ech., p. 26.
Encope **perspectiva** ! Agass. 1841. Mon. Scut., p. 51, *Pl. X b. f. 1–5.*

Encope micropora (*continued*).

Encope perspectiva ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 137.
" " ! Duj. Hupé, 1862. Échin., p. 568.
Echinoglycus *perspectiva* ! Gray, 1855. Cat. Rec. Ech., p. 26.
Encope tetrapora ! Agass. 1841. Mon. Scut., p. 49, *Pl. X* f. 1–3* (non Auct.). Galapagos.
" " ! Agass. 1847. C. R. Ann. Sc. N., VII. p. 137. (pars.)
Echinoglycus *tetrapora* ! Gray, 1855. Cat. Rec. Ech., p. 26.
Encope **occidentalis** ! Verrill, 1867. Notes Radiata, p. 309. Panama. Zorritos.
" *occidentalis* ! Verrill, 1871. Notes Radiata, *Pl. X. f. 4.*
" **Lapeyrousii** Mich. MS. (Écol. Min.).
" **elegans** Mich. MS. (Écol. Min.).
" **Sebae** Mich. MS. (Écol Min.).
" **mellitifrons** Mich. MS. (Écol. Min.).

*Lower California (Gibbes); *Guaymas (Stone); *Cape St. Lucas (Xanthus, Smithson. Coll.); Mazatlan ! (Bonn Mus. Écol. Min.); *Panama (Maack; Bradley, Yale Coll.); Galapagos.

(SPATANGUS.) Eupatagus.

Eupatagus Agass. 1847. C. R. Ann. Sc. Nat., VIII.

Eupatagus Valenciennesii

Eupatagus Valenciennesii ! Agass. 1847. C. R. Ann. Sc. Nat., VIII. p. 9, *Pl. XVI. f. 13.* New Holland.
Eupatagus Valenciennesii ! Gray, 1855. Cat. Rec. Ech., p. 49. Van Diemen's Land.
" " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XLII. f. 7.*
" " ! Duj. Hupé, 1862. Échin., p. 60.
" **similis** ! Gray, 1851. Ann. Mag. N. H., p. 130.

*New Holland; *Australia (Liverpool Mus.); Van Diemen s Land ! Port Dalrymple ! Bass Straits ! Flinder's Island ! (Brit. Mus.).

(HIPPONOË.) Evechinus.

Echinus Val. 1846. Voyage Vénus. (pars.)
Heliocidaris Desml. 1847. Agass. C. R. Ann. Sc. Nat., VII. (pars.)
Psammechinus Gir. 1850. Proc. Boston Sc. N. H.
" A. Agass. 1863. Bull. M. C. Z. (pars.)
Boletia Verrill, 1867. Notes Radiata. (pars.)
Evechinus Verrill, 1871. Notes Radiata.

Evechinus chloroticus

Echinus **chloroticus** ! Val. 1846. Voyage Vénus, Zooph., *Pl. VII. f 2.* New Zealand.
Heliocidaris *chlorotica* ! Desml. 1846. Agass. C. R. Ann. Sc. Nat, VI. p. 371.
Psammechinus chloroticus ! A. Agass. 1863. Bull. M. C. Z., I. p. 23.
Evechinus " ! Verrill, 1871. Notes Radiata, p. 584.
Psammechinus **asteroides** ! Gir. 1850 Proc. Bost. Soc. N. H, p. 366.
Boletia **viridis** ! Verrill, 1867. Notes Radiata, p. 304.

*New Zealand, *Auckland (Edwards).

(LINTHIA.) FAORINA.

Faorina GRAY, 1851. Ann. Mag. N. H.
Tripylus TROSCH. 1851. Wieg. Archiv, I. p. 72. (pars.)
Atrapus TROSCH. 1851. Wieg. Arch., I. p. 72.

Faorina chinensis

Faorina chinensis ! GRAY, 1851. Ann. Mag. N. H., VII. p. 132.
Faorina chinensis ! GRAY, 1855. Cat. Rec. Echin., p. 57, *Pl. VI. f. 1.* China.
Tripylus (**Atrapus**) **grandis** ! TROSCH. 1851. Wieg. Arch., p. 72, *Pl. I.*

*Shanghae; *Sandwich Islands? (Garrett); China! Hong Kong (Brit. Mus.).

FIBULARIA.

Echinus PALL. 1774. Spic. Zoöl.
Echinocyamus LESKE, 1778. KL. Addit. (pars.)
Fibularia LAMK. 1816. An. s. Vert. (pars.)
Fibularia AGASS. 1847. C. R. Ann. Sc. Nat., VII. (pars.)
Echinocyamus AGASS. 1847. C. R. Ann. Sc. Nat., VII. (pars.)
Mortonia GRAY, 1851. Proc. Zoöl. Soc. London (non DES. 1856).

Fibularia australis

..... SEBA, 1758. Thes., III. *Pl. XV. f. 36.*
Fibularia **australis** DESML. 1837. Syn., p. 240 (non A. AGASS.).
Echinocyamus australis ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 140. South Pacific.
" " DUJ. HUPÉ, 1862. Échin., p. 556.
" " ! MICH. 1859. Rev. Mag. Zoöl., p. 9, *Pl. XIV. f. 2.*
Mortonia *australis* ! GRAY, 1851. Proc. Zoöl. Soc. London, p. 38.
Mortonia " GRAY, 1852. Ann. Mag. N. H., p. 448. Australia.
" " GRAY, 1855. Cat. Rec. Ech., p. 37.

*Sandwich Islands, *Kingsmills Islands (Garrett); Ousima! Coral Sea of Australia! (W. Stimpson, Smithson. Coll.); South Sea! (J. d. P., Brit. Mus.).

Fibularia ovulum

Echinus **minutus** PALL. 1774. Spic. Zoöl., IX. *Pl. I. f. 3ª.*
" *minutus* GMEL. 1788. LINN. Syst. Nat., 3194.
Echinocyamus **craniolaris** LESKE, 1778. KL. Add., p. 150, *Pl. XLVII. f. 3ª.*
Echinus craniolaris GMEL. 1788. LINN. Syst. N., 3193.
Fibularia " DE FR. 1820. Dict. Sc. Nat., XVI. p. 512.
" " DES LONG. 1824. Enc. Méth., *Pl. CLIV. f. 1, 2.*
" " ! BLAINV. 1834. Actin., p. 211.
" " ! AGASS. 1836. Prod., p. 20.
" " GRAY, 1855. Cat. Rec. Echin., p. 29.
Echinocyamus **nucleo cerasi** LESKE, 1778. KL. Add.
" **cervum** LESKE, 1778. KL. Add.
Echinus cervum GMEL 1788. LINN. Syst. N, 3193.
Echinocyamus **vertice centrali** LESKE, 1778. KL. Add.
" **turcicus** LESKE, 1778. KL. Add.
Echinus turcicus GMEL. 1788. LINN. Syst. N. 3193.

Fibularia ovulum (*continued*).

Echinocyamus **ovatus** Leske, 1778. Kl. Add.
" **lathyrus** Leske, 1778. Kl. Add., *Pl. XXVIII. f. 1.*
Echinus lathyrus Gmel. 1788. Linn. Syst. N., 3194.
Fibularia " De Fr. 1820. Dict. Sc. Nat., XVI. p. 512.
" " Des Long. 1824. E. M., II. p. 390.
" " Desml. 1837. Syn., p. 240.
Echinocyamus **equinus** Leske, 1778. Kl. Add.
Echinus equinus Gmel. 1788. Linn. Syst. N., 3194.
Echinocyamus **inaequalis** Leske, 1778. Kl. Add.
Echinus inaequalis Gmel. 1788. Linn. Syst. N., 3194.
Fibularia " De Fr. 1820. Dict. Sc. Nat., XVI. p. 512.
" " Desml. 1837. Syn., p. 236.
Echinocyamus **cor ranae** Leske, 1778. Kl. Add.
" **cor raninum** Leske, 1778. Kl. Add.
Echinus **nucleus** Gmel. 1788. Linn. Syst. N., 3193.
Fibularia nucleus Desml. 1837. Syn., p. 240.
" *nucleum* De Fr. 1820. Dict. Sc. Nat., XVI. p. 511.
Echinus **centralis** Gmel. 1788. Linn. Syst. N., 3193.
" **ovulum** Gmel. 1788. Linn. Syst. N., 3194.
Fibularia *ovulum* ! Lamk. 1816. An. s. Vert., p. 17.
Fibularia " De Fr. 1820. Dict. Sc. Nat., XVI. p. 511.
" " ! Blainv. 1834. Actin., p. 211.
" " ! Agass. 1836. Prod., p. 20.
" " Desml. 1837. Syn., p. 240.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 142.
" " ! Gray, 1855. Cat. Rec. Ech., p. 30.
" " ! Duj. Hupé, 1862. Échin., p. 557.
Echinocyamus ovulum ! Gray, 1825. Ann. Phil., p. 6.
Echinus **faba** Gmel. 1788. Linn. Syst. N., 3194.
" **raninus** Gmel. 1788. Linn. Syst. N., 3195.
" **bufonius** Gmel. 1788. Linn. Syst. N. 3195.
Fibularia trigona ! Lamk. 1816. An. s. Vert., p. 17.
Fibularia trigona De Fr. 1820. Dict. Sc. Nat., XVI. p. 511.
Echinocyamus trigona ! Gray, 1825. Ann. Phil., p. 6.
Fibularia trigona ! Blainv. 1834. Actin., p. 211.
" " Desml. 1837. Syn., p. 238.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 142.
" " ! Perrier, 1869. Pédic., p. 168.
" **nucleola** Des Long. 1824. E. M., II. 389.

*Indian Ocean; E. India Islands ! (J. d. P.); Philippine Islands ! (Semper).

Fibularia volva

Fibularia **volva** ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 142. Red Sea.
" *volva* ! Duj. Hupé, 1862. Échin.
Fibularia **oblonga** ! Gray, 1851. Proc. Zoöl. Soc., p. 37. N. Australia.
" *oblonga* ! Gray, 1855. Cat. Rec. Ech., p. 30, *Pl. II. f. 5.*

*Red Sea; N. Australia ! (Brit. Mus.); Channel of Formosa ? (Mus. Copenh.).

GONIOCIDARIS.

Cidarites LAMK. 1816. An. s. Vert. (pars.)
Cidaris BLAINV. 1834. Actinol. (pars.)
Goniocidaris DES. 1846. C. R. Ann. Sc. Nat., VI.
Temnocidaris (**A. Agass.**) 1863. Bull. M. C. Z., I. (non COTT.).

Goniocidaris canaliculata

Temnocidaris **canaliculata** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 18.

*So. Extrem. So. America (Mack); Cape Horn! (Brit. Mus.); Falkland Islands! (Cunningham); Straits Magellan! (Berlin Mus.); Rose Island! Orange Harbor! (U. S. Ex. Exped. Smithson. Coll.); Zanzibar! (Leipzig Mus.); Natal! (Krauss).

Goniocidaris geranioides

..... SEBA, 1758. Thes., III. *Pl. XIII. f. 8*, copied in Enc. M., *Pl. CXXXVI. f. 1.*
Cidarites **geranioides** ! LAMK. 1816. An. s. Vert., p. 56. E. India.
" *geranioides* DESML. 1837. Syn., p. 324.
Cidaris " ! BLAINV. 1834. Actinol, p. 231.
" " ! AGASS. 1836. Prod., p. 21. Port Western.
Goniocidaris *geranioides* ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 337. New Holland. New Ireland.
Goniocidaris " DESOR, 1855. Syn. Ech. foss., *Pl. I. f. 4.*
" " BRONN, 1859. Kl. u. Ord. Actin, *Pl. XLI., f. 2.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 472, *Pl. IX. f. 5.*
" " ! STEWART, 1866. Trans. Lin. Soc., XXV. *Pl. XLVIII. f. 13–16.*
" " ! PERRIER, 1869. Pédic., p. 132, *Pl. III. f. 12.*

*Port Western, Australia; *Hobart Town, Van Diemen's Land (Robertson); *East India; King George's Sound! Freemantle! E. coast Australia! Brisbane Water! (Brit. Mus.).

Goniocidaris tubaria

Cidarites **tubaria** ! LAMK. 1816. An. s. Vert., p. 57 (non *Steph. tubaria* A. AG.). New Holland.
" *tubaria* DESML. 1837. Syn., p. 326.
Cidaris " ! AGASS. 1834. Prod., p. 21.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 327.
" " ! DUJ. HUPÉ, 1862. Échin., p. 471.
" " ! LÜTK. 1864. Bid., p. 137.
" " ! PERRIER, 1869. Pédic., p. 127.
Goniocidaris **Quoyi** ! VAL. 1846. AGASS., DES. C. R. Ann. Sc. Nat., VI. p. 337. New Holland.
Goniocidaris Quoyi ! DUJ. HUPÉ, 1862. Échin., p. 486.
" " PERRIER, 1869. Pédic., p. 132.
Cidaris **spinulosa** ! GRAY, 1855. Proc. Zoöl. Soc. London, p. 38.

*Bass Straits (Mus. Godeff.); *Australia; *Tasmania (Liverpool Mus.); *Hobson Bay, Victoria (Edwards).

HEMIASTER.

Hemiaster Des. 1847. C. R. Ann. Sc. Nat., VII.
Tripylus Phil. 1845. Wieg. Archiv, I.
Abatus Trosch. 1851. Wieg. Archiv, I.

Hemiaster australis

Tripylus australis ! Phil. 1845. Wieg. Archiv, p. 347, *Pl. XI. f. 3.* So. Extrem. So. America.
Tripylus (**Abatus**) *australis* ! Trosch. 1851. Wieg. Arch., p. 72.
Brissopsis australis ! Agass. 1847. C. R. Ann. Sc. Nat., VIII. p. 5.
" " ! Duj. Hupé, 1862. Échin., p. 597.
Faorina " ! Gray, 1851. Ann. Mag. N. H., VII. p. 132.
Faorina " ! Gray, 1855. Cat. Rec. Echin., p. 57.

*M. C. Z.; Statten Land! So. Polar seas! (Brit. Mus.); So. Extrem. So. America! (Philippi); Cape Virgines; off La Plata! 50 fms. (Mus. Stockholm).

Hemiaster cavernosus

Tripylus cavernosus ! Phil. 1845. Wieg. Archiv, p. 345, *Pl. XI. f. 2.* So. Extrem. So. Am.
Tripylus (**Abatus**) *cavernosus* ! Trosch. 1851. Wieg. Archiv, p. 72.
Brissopsis cavernosa ! Agass. 1847. C. R. Ann. Sc. Nat., VIII p. 5.
" " ! Duj. Hupé, 1862. Échin p. 597.
Faorina " ! Gray, 1851. Ann. Mag. N. H., VII. p. 132.
Faorina " ! Gray, 1855. Cat. Rec. Echin., p. 57.
Faorina antarctica ! Gray, 1851. Ann. Mag. N. H., VII. p. 132. South Polar Sea.
Faorina antarctica ! Gray, 1855. Cat. Rec. Echin., p. 57.

*M. C. Z.; Statten Land (Brit. Mus.); Chili, So. Extrem. So. America! (Philippi).

(PSEUDODIADEMA.) HEMIPEDINA.

Hemipedina Wright, 1855. Brit. Ool. Ech.
Hemipedina Desor, 1856. Syn. Ech. foss.
Caenopedina A. Agass. 1869. Bull. M. C. Z., I.

Hemipedina cubensis

Caenopedina cubensis ! A. Agass. 1869. Bull. M. C. Z., I. p. 256. Straits of Florida.

*Off Havana, 270 fms., *Florida Gulf Stream, 138 fms. (Pourtalès).

HETEROCENTROTUS.

Echinometra ..... RUMPH, 1705. Amb. Rar. Kam.
Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Echinus LIN. 1758. Syst. Nat. (pars.)
Echinometra GRAY, 1825. Ann. Phil. (pars.)
Heterocentrotus BRANDT, 1835. Prod.
Acrocladia AGASS. 1840. Cat. Syst. Ectyp.
Acrocladia AGASS. 1846. C. R. Ann. Sc. Nat., VI.

Heterocentrotus mammillatus

..... RUMPH. 1705. Amb. Rar. Kam., *Pl. XIII. f. 1, 2.*
..... SEBA, 1758. Thes., III. *Pl. XIII. f. 1, 2*, copied in Enc. Méth., *Pl. CXXXVIII. f. 1, 3, 4.*
..... KNORR, 1771. Délic., *Pl. D. f. 3.*
Cidaris mammillata ! KLEIN, 1734. Nat. Disp. Ech., *Pl. VI. f. A, B.*
Cidaris mammillata LESKE, 1778. Kl. Add., *Pl. XXXIX. f. 1*, copied from SEBA.
Echinus mammillatus LINN. 1758. Syst. Nat., ed. X. p. 667.
" " GMEL. 1778. LINN. Syst. N., 3175.
" " ! LAMK. 1816. An. s. Vert., p. 51. Red Sea. East Indies.
" " ! BLAINV. 1825. Dict. Sc. Nat. O., p. 97.
Echinometra *mammillata* ! GRAY, 1825. Ann. Phil., p. 5.
Echinometra " ! BLAINV. 1834. Actin., p. 225.
" " ! AGASS. 1836. Prod., p. 22.
" " DESML. 1837. Syn., p. 264.
" " EDW. in CUV. Règ. An. Ed. Ill., *Pl. XIII. f. 1.*
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 12. Isle de France.
Heterocentrotus *mammillatus* BRANDT, 1835. Prod., p. 266.
Heterocentrotus " ! A. AGASS. 1863. Bull. M. C. Z, I. Sandwich Islands.
" " ! A. AGASS. 1863. Proc. A. N. S Phila., p. 354.
Acrocladia *mammillata* ! AGASS. 1840. Cat. Syst. Ectyp.
Acrocladia " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 374.
" " ! DUJ. HUPÉ, 1862. Échin., p. 539.
" " ! MART. 1866. Wieg. Arch., I. p. 166.
" " ! PERRIER, 1869. Pédic., p. 162, *Pl. VI. f. 1a-c.*
Echinus **carinatus** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 98. (pars.)
Echinometra carinata ! BLAINV. 1834. Actin., p. 225. (pars.)
" " DESML. 1837. Syn., p. 266. (pars.)
" " EYD. et SOUL. 1844. Voyage de la Bonite, Zoop., *Pl. I.*
Heterocentrotus *carinatus* BRANDT, 1835. Prod., p. 265.
" **Postellsii** BRANDT, 1835. Prod., p. 265. Bonin Islands.
Echinometra Postellsii DESML. 1837. Syn., p 268.
Acrocladia **hastifera** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 374. Sandwich Islands.
" *hastifera* ! DUJ. HUPÉ, 1862. Échin., p. 540.
" " ! PERRIER, 1869. Pédic., p. 164, *Pl. VI. f. 3 a, b.*
Echinometra **Blainvillii** DESML. 1837. Syn., p. 264. (pars.)
Acrocladia **Blainvillei** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 374. (pars.)
" *Blainvillei* ! DUJ. HUPÉ, 1862. Échin., p. 540. (pars.)
" **planissima** ! MART. 1866. Zool. Bot. Ges. Wien.
" *planissima* ! MART. 1869. Decken, Reise.
" **serialis** ! VAL. PER. 1869. Pédic., p. 165, *Pl. VI. f. 5a.*
Echinometra **depressa** ! BLAINV. MS. (J. d. P.). (pars)
" **coronata** ! BLAINV. MS. (J. d. P.).

*Sandwich Islands (Garrett); *Manila; *Bonin Islands (W. Stimpson, Smithson. Coll.); *Feejee Islands; *Jarvis Island, No. 1; *Mauritius (Pike); Bourbon! (Écol. Min.); Loo Choo Islands! (Smithson. Coll.); Siam! (Acad. N. S. Phila.); Caroline Islands (Martens); Seychelles! Guam! (J. d. P.); Molucca, Amboina, Flores, Timor (Martens); Philippine Islands! (Semper); Upolu! (Mus. Godeff.); New Caledonia! (Crosse); *Red Sea (Mus. Vienna).

Heterocentrotus trigonarius

..... GUALTERI, 1742. Index Test., *Pl. CVIII. f. B.*
..... SEBA, 1758. Thes., III. *Pl. XIII. f. 4*, copied in Enc. Méth., *Pl. CXXXIX. f. 2.*
Cidaris mammillata ! KLEIN, 1732. Nat. Disp. Ech., *Pl. VI. f. C, D.* (pars.)
Echinus **trigonarius** ! LAMK. 1816. An. s. Vert., p. 51.
" *trigonarius* ! BLAINV. 1825. Dict. Sc. Nat. O., p. 98.
Echinometra trigonaria ! BLAINV. 1834. Actin., p. 225.
" " ! AGASS. 1836. Prod., p. 23.
" " ! DESML. 1837. Syn., p. 266.
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 12. Isle de France.
Heterocentrotus *trigonarius* BRANDT, 1835. Prod., p. 266.
Acrocladia trigonaria ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 373. Salomon Islands.
" " ! DUJ. HUPÉ, 1862. Échin., p. 539.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. Kingsmills Islands.
" " ! STEWART, 1865. Trans. Lin. Soc., XXV. *Pl. L. f. 6.*
" " ! MART. 1866. Wieg. Arch., I. p. 167.
" " ! PERRIER, 1869. Pédic., p. 164, *Pl. VI. f. 4 a–c, f. 5 b.*
..... CARPENT. 1870. Month. Mic. J., *Pl. XLIX.*
Heterocentrus trigonarius MÜLL. 1854. Bau d. Ech., p. 8.
Echinus **carinatus** ! BLAINV. 1825. D. S. N. O., p. 98. (pars.)
Echinometra carinata ! BLAINV. 1834. Actin., p. 225. (pars.)
" " ! AGASS. 1836. Prod., p. 22. (pars.)
" " DESML. 1837. Syn., p. 264. (pars.)
" **Blainvillii** DESML. 1837. Syn., p. 264. (pars.)
Acrocladia **Blainvillei** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 374. (pars.)
" *Blainvillei* ! DUJ. HUPÉ, 1862. Échin., p. 540. (pars.)
Echinometra **pugionifera** DESML. 1837. Syn., p. 266.
Acrocladia **cuspidata** ! A. AGASS. 1863. Bull. M. C. Z, I. p. 21. Mauritius.
" *violacea* ! PERRIER, 1869. Pédic., p. 163, *Pl. VI. f. 2a, b, c, d.*
Echinometra **violacea** ! BLAINV. MS. (Mus. Paris.)
" **depressa** ! BLAINV. MS. (Mus. Paris.) (pars.)
Acrocladia **yanthina** MICH. MS. (Écol. Min.)
" **subviridis** MICH. MS. (Écol. Min.)

*Mauritius (Pike); *Society Islands, *Sandwich Islands, *Paumotu Islands, *Kingsmills Islands, (Garrett); *Tonga Tabu (U. S. Ex. Exp., Smithson. Coll.); Feejee Islands! (Smithson. Coll.); Salomon Islands! Madagascar! (J. d. P.); Ellice Islands! (Mus. Godeff.); New Caledonia! (Crosse); Java (Martens); Bourbon! (Écol. Min.).

HIPPONOË.

Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Echinus LAMK. 1816. An. s. Vert. (pars.)
Hipponoë GRAY, 1840. Syn. Brit. Mus.
Tripneustes AGASS. 1841. Int. Mon. Scut.
Tripneustes AGASS. 1846. C. R. Ann. Sc. Nat., VI.
Heliechinus GIR. 1850. Proc. Bost. Soc. N. H.

Hipponoë depressa

Tripneustes **depressus** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 24. Guaymas.
" *depressus* VERRILL, 1867. Notes Radiata, p. 375. La Paz.
" " ! VERRILL, 1869. Proc. Bost. Soc. N. H., p. 384.
" " ! VERRILL, 1871. Notes Radiata, p. 584.

*La Paz (Pedersen, Yale Coll.); *Atlata (Salmin); *Gulf of California (Pedersen, Yale Coll.); Guaymas! (Smithson. Coll.).

Hipponoë esculenta

..... SLOANE, 1725. Jam., *Pl. CCXLII. f. 1, 2.*
Cidaris *miliaris esculenta* ! KLEIN, 1734. *Pl. I. f. A, B.*
Cidaris esculenta **(Leske)** 1778. KL. Add., *Pl. I. f. A, B* (non RUMPH).
Echinus **ventricosus** ! LAMK. 1816. An. s. Vert., p. 44.
" *ventricosus* ! BLAINV. 1825. Dict. Soc. N. O., p. 91.
" " ! BLAINV. 1834. Actin., p. 229.
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn , p. 286.
" " Énc. Méth., *Pl. CXXXII. f. 2, 3*, copied from KLEIN.
Tripneustes *ventricosus* ! AGASS. 1841. Int. Mon. Scut.
Tripneustes " ! AGASS. 1847. C. R. Ann. Sc. N., VII. p. 363. Martinique. Yucatan.
" " ! DUJ. HUPÉ, 1862. Échin., p. 533.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 24. Florida.
" " ! LÜTK. 1864. Bid., p. 95. W. Indies.
" " ! PERRIER, 1869. Pédic., p. 154, *Pl. V. f. 4 a–d.*
Heliechinus Gouldii ! GIR. 1850. Proc. Boston Soc. N. H., p. 364.

*West Indies, Jamaica (Adams); *Hayti (Weinland, Uhler); *Cumana (Couthouy); *St. Thomas (Allen, Thayer Exp.); *Cuba; *Florida (Würdeman); Cape Florida (Holder, Mills, Woodbury); *Tortugas (Agassiz, Pourtalès); *Bermudas (Hammond); *Nassau (Shaw); *Bahamas (Bryant); *Key West (Pickering); *Florida Reef (Pourtalès); Cuba! (Arango); Martinique! Yucatan! (J. d. P.); Surinam! (Mus. Copenh.).

Hipponoë variegata

Echinus **esculentus** RUMPH, 1705. Amb. Rar. Kam.
Cidaris *assulata* ..... KLEIN, 1734. Nat. Disp. Echin., *Pl. IX. f. A, B.*
" " *variegata* ! KLEIN, 1734. Nat. Disp. Ech., *Pl. X. f. B, C.*
Cidaris **variegata** LESKE, 1778. KL. Add., p. 85, *Pl. X. f. B, C.*
" **sardica** LESKE, 1778. KL. Add., p. 146, *Pl. IX. f. A, B.*
Echinus sardicus ! LAMK. 1816. An. s. Vert., p. 45.
" " ! BLAINV. 1834. Actin., p. 229.
" " DESML. 1837. Syn., p. 284.
Tripneustes sardicus ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 363. Seychelles. Bombay.
" " ! DUJ. HUPÉ, 1862. Échin., p. 533.
" " ! MART. 1866. Wieg. Arch., I. p. 160. Timor, Flores.
Hipponoë sardica GRAY, 1855. Proc. Zoöl. Soc. London, p. 36.
" " A. AGASS. 1863. Bull. M. C. Z., I. p. 24. Zanzibar.
Cidaris ..... *angulosa* ! KLEIN, 1734. Nat. Disp. Ech., *Pl. II. f. F.* (pars.)
Cidaris **angulosa** LESKE, 1778. KL. Add., *Pl. II. f. F.*
Echinus angulosus ! BLAINV. 1825. D. S. N. O., p. 93.
" " ! BLAINV. 1834. Actin., p. 229.
Tripneustes " ! DUJ. HUPÉ, 1862. Échin., p. 533.
Echinus **pentagonus** ! LAMK. 1816. An. s. Vert., p. 46.
" *pentagonus* DESML. 1837. Syn., p. 288.
" " ! MICH. 1845. Rev. Mag. Z., p. 9. Isle de France.
Tripneustes " ! AGASS. 1847. C. R. Ann. Sc. Nat., VI. p. 363.
Echinus **subcoeruleus** ! LAMK. 1816. An. s. Vert., p. 49. So. Pacific.
" *subcoeruleus* ! BLAINV. 1825. D. S. N. O., p. 92.
" " ! BLAINV. 1834. Actin., p. 229.
" " DESML. 1837. Syn., p. 288.
Tripneustes " ! AGASS. 1847. C. R. Ann. Sc. Nat., VI. p. 363. Zanzibar.
" " ! DUJ. HUPÉ, 1862. Échin., p. 534.
" " ! PERRIER, 1869. Pédic., p. 155., *Pl. V. f. 5a, c.*
Echinus **fasciatus** ! LAMK. 1816. An. s. Vert., p. 45. Isle de France.
" *fasciatus* ! BLAINV. 1834. Actin., p. 229, *Pl. XX. f. 4.*

Hipponoë variegata (*continued*).

Echinus fasciatus Desml. 1837. Syn., p. 288.
" " ! Mich. 1845. Rev. Mag. Zoöl., p. 9.
Tripneustes " ! Duj. Hupé, 1862. Échin., p. 533.
Echinus **virgatus** ! ? Lamk. 1816. An. s. Vert., p. 44.
" *virgatus* Blainv. 1834. Actin., p. 229.
" " Desml. 1837. Syn., p. 286.
" **inflatus** ! Blainv. 1825. Dict. Sc. N. O., p. 91.
" **Peronii** ! Blainv. 1825. Dict. Sc. N. O., p. 92.
" *Peronii* ! Blainv. 1834. Actin., p. 229.
" " Desml. 1837. Syn., p. 228.
Tripneustes Peronii ! Perrier, 1869. Echin., p. 157.
" **bicolor** ! Val. Perr., 1869. Pédic., p. 156, *Pl. V. f. 6 a, b, c.*
" **fuscus** ! Mich. 1862. Maillard, Bourbon Annéx. A, p. 5. Bourbon.
" **zigzag** ! Mich. 1862. Maillard, Bourbon Annéx. A, p. 5. Bourbon.
Hipponoë **violacea** ! A. Agass. 1863. Bull. M. C. Z., I. p. 24. Sandwich and Kingsmills Islands.
" *violacea* ! A. Agass. 1863. Proc. A. N. S. Phila., p. 358. Japan. Loo Choo.
" **nigricans** ! A. Agass. 1863. Bull. M. C. Z., I. p. 24. Society Islands.
Tripneustes **Senkenbergianus** Trosch. MS. (Mus. Frankft.),

*Sandwich, *Kingsmills, *Society Islands (Garrett); *Ousima (W. Stimpson, Smithson. Coll.); *Indian Ocean; *Tor, Red Sea (Mus. Vienna); *Zanzibar (Cheney); *Mozambique (Cook); *Mauritius (Pike); Bombay! Seychelles (J. d. P.); Nikobar! Amboina! (Mus. Copenh.); Samoa! (Ac. N. S. Phila.); Timor, Floies, Batyang, Moluccas (Martens); Reef of Omaga (Brit. Mus.); Philippine Islands! (Semper); Feejee Islands! Pelew Islands! (Mus. Godeff.).

(AMBLYPNEUSTES.) Holopneustes.

Holopneustes Agass. 1841. Anat. Genre Ech., Val.
Holopneustes Agass. 1846. C. R. Ann. Sc. Nat., VI.
Amblypneustes Lütk. 1864. Bid. (pars.)

Holopneustes inflatus

Amblypneustes **inflatus** Lütk. MS. 1872, in A. Agass. Bull. M. C. Z., III. p. 18. Australia.
Holopneustes inflatus A. Agass. 1872. Bull M C. Z., III. p. 18.

*M. C. Z.; New Holland! (Mus. Copenh.).

Holopneustes porosissimus

Cidaris granulata ! (Ag.) 1841. Int. Monog. An. Ech., Val. (non Leske).
Holopneustes *granulatus* ! Agass. 1841. Int. Monog. An. Ech., Val. (non Leske).
Holopneustes **porosissimus** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 364, *Pl. XV. f. 16.*
" *porosissimus* ! Duj. Hupé, 1862. Échin., p. 536.

*M. C. Z., Australia (J. d. P.).

Holopneustes purpurescens

Amblypneustes **purpurescens** Lütk. MS. 1872, in A. Agass. Bull. M. C. Z., III. Australia.
Holopneustes purpurescens A. Agass. 1872. Bull. M. C. Z., III.

*Hobart Town (Hamburg Mus.); *Australia, Murray Riv.! W. Australia (Brit. Mus.).

HOMOLAMPAS.

Lissonotus (**A. Agass.**) 1869. Bull. M. C. Z. (non Schönh. 1817.)
Homolampas.

Homolampas fragilis

Lissonotus **fragilis** ! A. Agass. 1869. Bull. M. C. Z., I. 273. Straits of Florida.

*Off Bocca grande, 368 fms., *off Carysfort Reef, 320 fms. (Pourtalès); Josephine Bk ! 500–600 fms. (Mus. Stockholm).

LAGANUM.

Laganum Klein, 1734. Nat. Disp. Ech.
Echinodiscus Leske, 1778. Kl. Addit. (pars.)
Echinus Gmel. 1788. Syst. Nat. (pars.)
Clypeaster Lamk. 1816. An. s. Vert. (pars.)
Scutella Lamk. 1816. An. s. Vert. (pars.)
Lagana Blainv. 1827. Dict. Sc. Nat.
Laganum Agass. 1841. Mon. Scut.

Laganum Bonani

? ..... Rumph, 1705. Amb. Rar. Kam., *Pl. XIV. f. E.* Amboina.
..... Gualteri, 1742. Index Test., *Pl. CX. f. C.*
Echinus planus ..... Seba, 1758. Thes., III. *Pl. XV. f. 25, 26.*
Laganum Bonani ! Klein, 1734. Nat. Disp. Ech., *Pl. XXII. f. a, b.*
Laganum Bonani ! Agass. 1841. Mon. Scut., p. 108, *Pl. XXII. f. 25–29; Pl. XXIII. f. 8–12.* New Guinea. Vanikoro.
" " ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " ! Gray, 1855. Cat. Rec. Ech., p. 12. Philippine Islands. Siguigor.
" " ! Desor, 1855. Synop. Éch., *Pl. XXVII. f. 29, 30.*
" " ! Duj. Hupé, 1862. Échin., p. 560.
" " Mart. 1866. Wieg. Arch., I. p. 172. Java. Timor. Molucca.
" " Edw. in Cuv. Règ. An. Ed. Ill., *Pl. XVI. f. 2.*
Echinodiscus **laganum** Leske, 1778. Kl. Add., *Pl. XXII. f. a, b.*
Echinus laganum Gmel. 1788. Linn. Syst. Nat., 3190.
Clypeaster laganum ! Lamk. 1816. An. s. Vert, p. 15.
Lagana " ! Gray, 1825. Ann. Phil.
Lagana " ! Blainv. 1834. Actin., p. 215.
Scutella " ! Blainv. 1827. D. S. N., Art. Scut., p. 229.
" " ! Desml. 1837. Syn., p. 230.
Lagana minor ! Gray, 1825. Ann. Phil., p. 6

*Tasmania (Liverpool Mus.); *Amboina (J. d. P.); New Guinea! Vanikoro! Australia! (J. d. P.); Siguigor! (Brit. Mus.); Philippine Islands! (Semper); Pelew Islands! (Mus. Godeff.); Java, Amboina, Molucca (Martens).

Laganum depressum

Laganum **depressum** ! Less. 1841. Agass. Mon. Scut., p. 110, *Pl. XXIII. f. 1–7.* Moluccas.
" *depressum* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " ! Gray, 1855. Cat. Rec. Ech., p. 10. Australia. Philippine Islands. Mauritius.
" " ! Duj. Hupé, 1862. Échin., p. 560.
" " ! A. Agass. 1863. Bull. M. C. Z., I. p. 26. Kingsmills Islands.
" " ! Mart. 1866. Wieg. Arch., I. p. 193. China. Makao.
" **Tonganense** ! Quoy et Gaim. 1841. Agass. Mon. Scut., p. 114, *Pl. XXVI. f. 7–19.* Tonga. New Guinea. Vanikoro.
" *Tonganense* ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " ! Duj. Hupé, 1862. Échin., p. 560.
" **ellipticum** ! Agass. 1841. Mon. Scut., p. 111, *Pl. XXIII. f. 13–15.*
" *ellipticum* ! Gray, 1855. Cat. Rec. Ech., p. 12.
" " ! Duj. Hupé, 1862. Échin., p. 560.
" **attenuatum** ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 132. Red Sea. Persian Gulf.
" *attenuatum* ! Gray, 1855. Cat. Rec. Ech., p. 10.
" **cingulatum** ! Agass. 1847. C. R. Ann. Sc. Nat., VII. p. 133. Salomon Islands.
" *cingulatum* ! Gray, 1855. Cat. Rec. Ech., p. 11.
" *scutiforme* ! Duj. Hupé, 1862. Échin., p. 560.
Lagana **depressa** ! Less. MS. (Mus. Paris.)
" **Tonganense** ! Quoy et Gaim. MS. (Mus. Paris.)

*Kingsmills Islands (Garrett); Tonga! Amboina! New Guinea! Buru! Moluccas! Vanikoro! Salomon Islands! (J. d. P.); Salerno (Gray); Zanzibar! (J. d. P., Mus. Copenh.); *Sandwich Islands (Pease); *So. Pacific; New Caledonia! (Crosse); Persian Gulf! Waigiou! Madagascar, Nos-Bé! Darnley Islands! Australia! Siguigor! Mauritius! (Brit. Mus.); Philippine Islands! (Semper); Feejee Islands! (Mus. Godeff.); Makao (Martens).

Laganum Putnami

Laganum **Putnami** ! Barn. 1863, in Ag. Proc. Ac. N. S. Phil., p. 359. Ousima.

*Ousima (W. Stimpson, Smithson. Coll.); *Japan (Salmin).

LINTHIA.

Desoria (**Gray**), 1851. Ann. Mag. N. H., VII. p. 132 (non Agass. 1841).
Linthia Mer. 1853, in Des. Act. Soc. Helv.
Epiaster D'Orbig. 1854. Pal. Franç. Terr. crét. (pars.)

Linthia australis

Desoria **australis** ! Gray, 1851. Ann. Mag. N. H., VII. p. 132. Flinder's Island.
" *australis* ! Gray, 1855. Cat. Rec. Echin., p. 58, *Pl. VI. f. 2.* Van Diemen.
" **nodosa** ! Verrill, 1869. Proc. Bost. Soc. N. H., XII. p. 382.

*Tasmania (B. M. Wright); *Australia; Flinder's Island! (Brit. Mus.).

LOVENIA.

Spatangus GRAY, 1845. EYRE, Voyage Discovery, I.
Lovenia AGASS. 1847. C. R. Ann. Sc. Nat, VIII.

Lovenia cordiformis

Lovenia **cordiformis** ! LÜTK. MS. 1872. A. AGASS. Bull. M. C. Z., III. San Diego. Guaymas.
" **Americana** ! A. AGASS. MS. (M. C. Z.)

*Guaymas, Gulf of California (Stone); San Diego! (Cassidy, Smithson. Coll.); Guayaquil! (Mus. Copenh.).

Lovenia elongata

..... AUDOUIN in SAVIGNY, Égypte, Zooph., *Pl. VII. f. 4.*
Spatangus **elongatus** GRAY, 1845, in EYRE, Voy., I. p. 436, *Pl. VI. f. 2.* Australia.
Lovenia elongata ! GRAY, 1851. Ann. Mag. N. H., p. 131. Port Western.
" " ! GRAY, 1855. Cat. Rec. Echin., p. 45.
Lovenia hystrix ! DES. 1847. AG. C. R. Ann. Sc. Nat., VIII. p. 11, *Pl. XVI. f. 16.* Red Sea.
Lovenia hystrix ! GRAY, 1855. Cat. Rec. Ech., p. 45.
" " ! DUJ. HUPÉ, 1862. Échin., p. 606, *Pl. IX. f. 11.*

*Red Sea; *Zanzibar (Webb, Cheney, Cook); Port Essington, W. Australia! (Brit. Mus.); Philippine Islands! (Semper).

Lovenia subcarinata

Spatangus **subcarinatus** GRAY, 1845. EYRE, Voyage, I. p. 436. Philippine Islands.
Lovenia subcarinata ! GRAY, 1851. Ann. Mag. N. H., p. 131.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 45, *Pl. V. f. 3.* Luzon.
" " ! A. AGASS. 1863. Proc. Ac. N. S. Phila., p. 360.
" **triangularis** ! A. AGASS. 1863. Proc. A. N. S. Phila., p. 360. Kagosima.

*China Seas (Salmin); Kagosima Bay! Hong Kong! (W. Stimpson, Smithson. Coll.); Philippine Islands, Luzon! (Brit. Mus., Semper); Honolulu! (Stockholm Mus.).

(SPATANGUS.) MARETIA.

Spatangus LESKE, 1778. KL. Addit. (pars.)
" LAMK. 1816. An. s. Vert. (pars)
Maretia GRAY, 1855. Cat. Rec. Echin.
Hemipatagus MICH. 1862. MAILLARD Bourbon, An. A.
Lovenia PERRIER, 1869. Pédic. (pars.)
Hemipatagus DES. 1858. Syn. Éch. foss.
Thrichoproctus AGASS. MS. (M. C. Z.)
Plagiopatagus LÜTK. MS. in litt.

Maretia alta

Maretia **alta** ! A. AGASS. 1863. Proc. Ac. N. S. Phil., p. 360. Kagosima.

*Kagosima Bay (W. Stimpson, Smithson. Coll.); *Formosa (Mus. Godeff.).

Maretia planulata

..... SEBA, 1725. Thes., III. *Pl. XV. f. 27, 28*, copied in E. M., *Pl. CLIX. f. 5, 6.*
Spatangus **ovatus** LESKE, 1778. KL. Add., *Pl. XLIX. f. 12, 13* (non LAMK. nec KLEIN).
" **planulatus** ! LAMK. 1816. An. s. Vert., p. 31. So. Pacific.
" *planulatus* ! BLAINV. 1825. Dict. S. N., L. p. 91.
" " ! AGASS. 1836. Prod., p 17.
" " DESML. 1837. Syn., p. 378.
" " ! MICH. 1845. Rev Mag. Zoöl., p. 9. Isle de France.
" " ! AGASS. 1847. C. R. Ann. Sc Nat., VIII. p. 7. Java. Waigiou.
" " ! DUJ. HUPÉ, 1862. Échin., p. 608.
" " MART. 1866. Wieg. Arch., I. p. 180. Molucca.
" " ! MART. 1867. Wieg. Arch., I. p. 113, *Pl. III. f. 4.*
" " ! PERRIER, 1869. Pédic., p. 180, *Pl. VII. f. 7 a, c.*
Maretia *planulata* ! GRAY, 1855. Cat. Rec. Echin., p. 48. Masbate. Borneo.
Maretia " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 27. Kingsmills Islands.
Hemipatagus **mascareignarum** ! MICH. 1862. MAILLARD, Bourbon An. A, p. 6, *Pl. XVI. f. 2.* Bourbon.
Maretia **variegata** ! GRAY, 1866. Proc. Zoöl. Soc. Lond., p. 170, *f.*
Lovenia **quadrimaculata** ! VAL. 1869. in PERRIER, Pédic., p. 178.
Thrichoproctus tenuis ! AGASS. MS. Mus. Comp. Zoöl.
Plagiopatagus *variegatus* ! LÜTK. MS. in Litt.

*Waigiou; *Kingsmills Islands (Garrett); *China Seas, *Java (Liverpool Mus.); *Bourbon (Maillard, Cotteau); *Siam (Salmin); *New Caledonia (Crosse); Masbate! Borneo! (Brit. Mus.); Philippine Islands (Semper); Banca Straits! (Salmin); Molucca (Martens).

MELLITA.

Mellita KLEIN, 1734. Nat. Disp. Ech. (pars.)
Echinodiscus LESKE, 1788. KL. Addit. (pars.)
Clypeaster LAMK. 1816. An. s. Vert. (pars.)
Scutella LAMK. 1816. An. s. Vert. (pars.)
Mellita AGASS. 1841. Monog. Scut.
Leodia GRAY, 1851. Proc. Zoöl. Soc. London.
Encope AGASS. 1841. Mon. Scut. (pars.)
Echinoglycus GRAY, 1855. Cat. Rec. Ech. (pars.)

Mellita erythrea

Mellita **erythrea** ! GRAY, 1851. P. Z. S. L., p. 36. Red Sea.
" **sp.** ! A. AGASS. 1863. Proc. A. N. S. Phil., p. 359.

Red Sea! (J. d. P. Brit. Mus.).

Mellita longifissa

Mellita **longifissa** ! MICH. 1858. R. M. Z., No. 8.
" *longifissa* ! DUJ. HUPÉ, 1862. Échin., p. 567, *Pl. IX. f. 6.*
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 26. Panama.
" " ! VERRILL, 1869. Proc. N. H. S. Boston, p. 383. Nicaragua.
" " ! VERRILL, 1871. Notes Radiata, p. 588. La Paz.

*Panama (Adams, Maack); *Acapulco (A. Agassiz); La Paz! Acajutla! (Yale Coll.).

Mellita pacifica

Mellita **pacifica** ! VERRILL, 1867. Notes on Radiata, p. 313. Zorritos.

Zorritos, Peru ! (Yale Coll.).

Mellita sexforis

..... SEBA, 1758. Thes., III. *Pl. XV. f. 7, 8.*
..... KNORR, 1771. Délic., *Pl. DI. f. 17.*
Echinodiscus **sexiesperforatus** LESKE, 1778. KL. Add., p. 135, *Pl. L. f. 3, 4,* copied in Enc. Méth., *Pl. CXLIX. f. 1, 2.*
Echinus **hexaporus** GMEL. 1788. LINN. Syst. N., 3189.
Scutella hexapora ! BLAINV. 1834. Actin., p. 219.
" " ! AGASS. 1836. Prod., p. 188.
" " EDW. in CUV. Règ. An. Ed. Ill., *Pl. XV. f. 1.*
Scutella sexforis ! LAMK. 1816. An. s. Vert., p. 9. Ocean Ind. et Americ.
Scutella sexforis ! BLAINV. 1827. D. S. N. Scut., p. 223.
" " DESML. 1837. Syn., p. 224.
Mellita hexapora ! AGASS. 1841. Mon. Scut., p. 41, *Pl. IV. f. 4–7; Pl. IV a. f. 11, 12.* Martinique. Mexico.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 138.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 23. St. Vincent Island.
" " ! MICH. 1858. Rev. Mag. Zoöl., No. 8.
" " ! DUJ. HUPÉ, 1862. Échin., p. 566, *Pl. X. f. 11, 12.*
" " ! LÜTK. 1864. Bid., p. 109, *Pl. II. f. 3.* W. Indies.
" **similis** ! AGASS. 1841. Mon. Scut., p. 43, *Pl. IV. f. 1–3.* Porto Rico.
" *similis* ! MICH. 1858. Rev. Mag. Zoöl., No. 8.
" " ! DUJ. HUPÉ, 1862. Échin., p. 567.
? *Scutella* **caroliniana** ! RAV. 1842. J. Ac. N. S. Phila., p. 333.
? *Mellita caroliniana* ! MCCRADY, 1857. Plio. Foss. So. Ca., *Pl. V. f. 4.*
Leodia Richardsonii ! GRAY, 1851. Proc. Zoöl. Soc. Lond., p. 36.
Leodia Richardsonii ! GRAY, 1855. Cat. Rec. Ech., p. 19.

*West Indies; *Charleston, S. C.; *Bermudas (Hill); *Florida, *Cuba (Arango); *Rebecca Shoal, 11 fms., *Double Head Shot Key, 4–6 fms., *Salt Key, *off Cherura, 270 fms. (Pourtalès); Martinique ! Mexico ! Porto Rico ! St. Vincent ! (Brit. Mus.).

Mellita Stokesii

Encope **Stokesii** ! AGASS. 1841. Mon Scut., p. 59, *Pl. VI a. f. 1–8.* Galapagos.
" *Stokesii* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 137. Guayaquil.
" " ! DUJ. HUPÉ, 1862. Échin., p. 569.
" " ! LÜTK. 1864. Bid., p. 133. Punta Arenas.
Echinoglycus Stokesii ! GRAY, 1855. Cat. Rec. Ech., p. 27.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 26. Panama.
" " VERRILL, 1867. Notes Radiata, p. 312.

*Panama (Adams, Maack, Bradley, Yale Coll.); Punta Arenas ! Guayaquil ! Galapagos ! (Mus. Copenh.).

Mellita testudinata

Mellita testudinata ! KLEIN, 1734. Nat. Disp. Ech., *Pl. XXI. f. C, D,* copied in Enc. M., *Pl. CXLIX. f. 3, 4.*
Mellita testudinata ! AGASS. 1841. Mon. Scut., p. 40, *Pl. IV a. f. 7–9.* Vera Cruz.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 138.
" " ! MICH. 1858. Rev. Mag. Zoöl., No. 8.
" " ! DUJ. HUPÉ, 1862. Échin., p. 566.
..... GUALTERI, 1742. *Pl. CX. f. E.*
..... SEBA, 1758. Thes., III. *Pl. XV. f. 9, 10.*
..... KNORR, 1771. Délic., *Pl. DI. f. 16.*

Mellita testudinata (*continued*).

? *Echinus* **orbiculus** LINN. 1758. Syst. Nat., Ed. X. p. 666.
Echinodiscus **quinquiesperforatus** ! LESKE, 1778. KL. Add., p. 133, *Pl. XXI. f. C, D.*
Echinus **pentaporus** GMEL. 1788. LINN. Syst. N., 3189.
Clypeaster pentaporus ! LAMK. 1801. An. s. Vert., p. 349.
Scutella pentapora ! BLAINV. 1834. Actin., p. 219.
" " ! AGASS. 1836. Prod., p. 188.
Encope " ! AGASS. 1841. Mon. Scut., *Pl. III.*
Mellita " ! LÜTK. 1864. Bid., p. 107.
Scutella quinquefora ! LAMK. 1816. An. s. Vert., p. 9.
Scutella quinquefora ! BLAINV. 1827. D. S. N. Scut., p. 223.
" " ! DESML. 1837. Syn., p. 224.
Mellita " ! AGASS. 1841. Mon Scut., p. 36, *Pl. III.* So. Carolina. Porto Rico.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 138. Cuba.
" " MICH. 1858. Rev. Mag. Zoöl., No. 8.
" " ! BRONN, 1859. KL. u. Ord. Actin, *Pl. XXXIX. f. 15.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 566.
? " **ampla** ! HOLMES, 1848. in RAV. Ech. So. Carolina.
? " *ampla* ! HOLMES, 1860. Post. Pl. Foss. So. Ca., *Pl. I. f. 6.*
" **testudinaria** GRAY, 1851. Proc. Zoöl. Soc. Lond.
" **testudinea** ! GRAY, 1855. Cat. Rec. Ech., p. 22. Brazil.

*Itabapuana, *Rio Doce (Hartt, Copeland, Thayer Exp.); *Marañhao (Agassiz, Thayer Exp.); *Cumana, Venez. (Couthouy); *Jamaica (Adams); Cuba! (Arango); Porto Rico! Vera Cruz! (J. d. P.); *Texas (Stolley); *Captiva Key, *Key Biscayne, Fla. (Würdeman); *Amelia Island, Fla. (Scudder); *Florida, 7 fms. (Pourtalès); *Savannah, *Charleston, S. C., Nantucket! (Agassiz); *Beaufort, N. C. (Stimpson, Bickmore); *Hogg Island, Va. (Stimpson); Vineyard Sound (Verrill).

(BRISSUS.) MEOMA.

Spatangus LAMK. 1816. An. s. Vert. (pars.)
Brissus GRAY, 1825. Ann. Phil. (pars.)
Schizaster D'ORBIG. 1847. AGASS. C. R. Ann. Sc. Nat. VIII.
Meoma GRAY, 1851. Ann Mag. N. H. VII.
Periaster DUJ. HUPÉ, 1862. Échin. (pars.)
Kleinia A. AGASS. 1863. Bull. M. C. Z., I.
Rhyssobrissus A. AGASS. 1863. Bull. M. C. Z., I.
Hemibrissus POMEL, 1869. Revue des Échinod.
Breynia PERRIER, 1869. Pédic. (pars.)

Meoma grandis

Meoma grandis ! GRAY, 1851. Ann. Mag. N. H., VII. p. 132. Australia??
Meoma grandis ! GRAY, 1855. Cat. Rec. Echin., p. 56, *Pl. V. f. 2.*
" *nigra* ! VERRILL, 1867. Notes Radiata, p. 317.
" " VERRILL, 1871. Notes Radiata. La Paz. Gulf of California.
Kleinia **nigra** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 27. Acapulco.
Rhyssobrissus *niger* ! A. AGASS. 1863. Bull. M. C. Z., I. p. 27.
Breynia nigra ! PERRIER, 1869. Pédic., p. 174.

*Acapulco (Van Brunt, A. Agassiz); La Paz! (Yale Coll.); *Gulf of California (Stone); *Mexican coast; Cape St. Lucas! (Xanthus, Smithson. Coll.).

Meoma ventricosa

Spatangus **ventricosus** ! LAMK. 1816. An. s. Vert., p. 29. Antilles.
" *ventricosus* BLAINV. 1834. Actin., p. 203.
Brissus " ! GRAY, 1825. Ann. Phil., p. 9.
" " ! AGASS. 1836. Prod., p. 184.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat. VIII., p. 13.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 54.
" " ! DUJ. HUPÉ, 1862. Échin., p. 605.
Meoma ventricosa ! LÜTK. 1864. Bid., p. 120.
Schizaster **cubensis** ! D'ORBIG. 1847, in AGASS. C. R. Ann. Sc. Nat., VIII. p. 22 (non A. AGASS.).
Periaster *cubensis* ! D'ORBIG. 1854. Pal. fr., p. 270.
Brissus **panis** ! GRUBE, 1857. Wieg. Arch., p. 344.
" *panis* ! GRUBE, 1857. Nov. Act., p. 47, *Pl. III. f. 5, 6.*
" **spatiosus** MCCRADY, 1857. Plio. foss. So. Ca., p. 8, *Pl. III. f. 1.*
Hemibrissus *ventricosus* POMEL, 1869. Rev. d. Échinod., p. XIII.

*W. Indies; *Florida Reef, *Tortugas, *off Tennessee Reef, 85, 115 fms. (Pourtalès); Honduras! (Mus. Copenh.); Guadeloupe! (J. d. P.).

MESPILIA.

Cidaris KLEIN, 1734. Nat. Disp. Echin. (pars.)
Echinus LINN. 1758. Syst. Nat. (pars.)
Microcyphus AGASS. 1841. Introd. Monog. Scut. (non AGASS. 1846).
Mespilia AGASS. 1846. C. R. Ann. Sc. Nat. VI.

Mespilia globulus

Cidaris *assulata granulata* KLEIN, 1734. Nat. Disp. Ech., *Pl. X. f. E, F.*
Cidaris **granulata** LESKE, 1778. *Pl. X. f. E, F.*
Echinus **globulus** LINN. 1758. Syst. Nat. Ed. X.
" *globulus* GMEL. 1788. LINN. Syst. N.
" " ! BLAINV. 1825. Dict. Sc. N. O., p. 82.
" " ! ENC. MÉTH. *Pl. CXLII. f. 1, 2.*
" " BLAINV. 1834. Actin., p. 227.
" " DESML. 1837. Syn., p. 274.
Mespilia " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 358, *Pl. XV. f. 17.* Tonga Tabu.
Mespilia " ! DUJ. HUPÉ, 1862. Échin., p. 517.
" " ! A. AGASS. 1863. Proc. A. N. S. Phila., p. 358. Ousima.
" " ! STEWART, 1865. Trans. Lin. Soc., XXV. *Pl. L. f. 8.*
Echinus **versicolor** ! VAL. 1841, in AGASS. Monog. Scut., p. 7.
Microcyphus *versicolor* ! AGASS. 1841. Monog. Scut., p. 7.
Microcyphus " ! DUJ. HUPÉ, 1862. Échin., p. 517.
Mespilia **Verrauxi** ! MICH. M.S. (Écol. Min.)

*Ousima (Stimpson, Smithson. Coll.); *Tonga Tabu; *Samoa (Mus. Godeff.); China! (Mus. Copen.); Philippine Islands! (Semper); Sandwich Islands! (Mus. Godeff.).

(BRISSUS.) METALIA.

Spatangus KLEIN, 1734. Nat. Disp. Echin. (pars.)
Brissus AGASS. 1836. Prod. (pars.)
Plagionotus (**Agass.**) 1847. C. R. Ann. Sc. Nat., VIII. (non MULS. 1842).
Metalia GRAY, 1855. Cat. Rec. Ech.
Xanthobrissus A. AGASS. 1863. Bull. M. C. Z.
Bryssus MARTENS, 1869. Decken's Reise.
Leiopatagus POMEL, 1869. Int. Rev.

Metalia africana

Plagionotus **africanus** ! VERRILL, 1871. Notes Radiata, p. 569. Sherboro Island. W. Africa.

Sherboro Island ! (Yale Coll.).

Metalia maculosa

..... RUMPH. 1705. Amb. Rar. Kam., *Pl. XIV. f. I.* Amboina.
..... GUALTERI, 1742. Ind. Test., *Pl. CIX. f. A.*
..... SEBA, 1758. Thes. III. *Pl. X. f. 22, a, b,* copied in Enc. Méth., *Pl. CLVIII. f. 7, 8.*
Spatangus *Brissus maculosus angustus* ! KLEIN, 1734. Nat. Disp. Ech., *Pl. XXIV. f. A, B.*
Spatangus " " LESKE, 1778. KLEIN, Add., *Pl. XXIV. f. A, B.* (pars.)
Echinus **maculosus** GMEL. 1788. LINN. Syst. N., 3199.
Spatangus maculosus BLAINV. 1829. Dict. Sc. Nat., L. p. 92.
" " DESML. 1837. Syn., p. 382.
Brissus " MART. 1866. Wieg. Arch., I. p. 181.
Spatangus **compressus** ! LAM. 1816. An. s. Vert., p. 30. Isle de France.
Spatangus compressus DESML. 1837. Syn., p. 388.
Brissus compressus ! AGASS. 1836. Prod., p. 18.
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 7.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 13.
" " ! GRAY, 1855. Cat. R. Ech., p. 53.
" " ! DUJ. HUPÉ, 1862. Échin., p. 606.
" " ! MART. 1866. Wieg. Arch., I. p. 183. Mozambique.
Metalia **nobilis** ! VERRILL, 1867. Notes Radiata, p. 319. Cape St. Lucas. Panama.
" *nobilis* ! VERRILL, 1871. Notes Radiata, p. 591.
Plagionotus nobilis ! A. AGASS. 1869. Bull. M. C. Z., I. p. 302.
" **timorensis** MICH. MS. (Écol. Min.).

*Samoa (Mus. Godeff.); *Sandwich, Kingsmills, and Society Islands (Garrett); Philippine Islands ! (Semper); Timor, Flores, New Holland (Martens); Isle de France ! Bourbon ! (J. d. P.); Panama ! (Bradley, Yale Coll.); Cape St. Lucas ! (Smithson. Coll.).

Metalia pectoralis

Echinanthus maximus ..... SEBA, 1758. Thes., III. *Pl. XIV. f. 5, 6,* copied in Enc. Méth., *Pl. CLIX. f. 2, 3.*
Echinus **grandis** GMEL. 1788. LINN. Syst. N.
Spatangus **pectoralis** ! LAMK. 1816. An. s. Vert., p. 29.
" *pectoralis* DESLONG. 1824. E. M., II. p. 686.
" " ! BLAINV. 1829. Dict. Sc. N., L. p. 88.
" " ! BLAINV. 1834. Actin., p. 203.
" " DESML. 1837. Syn., p. 380.
Brissus " ! AGASS. 1836. Prod, p. 184.
Plagionotus pectoralis ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 13, *Pl. XVI. f. 15.* Mexico. Bahia.

Metalia pectoralis (*continued*).

Plagionotus pectoralis ! GRAY, 1855. Cat. Rec. Ech., p. 50.
" " ! DUJ. HUPÉ, 1862. Échin., p. 606.
" " ! LÜTK. 1864. Bid., p. 122.
" " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 275. Straits of Florida.
" " ! PERRIER, 1869. Pédic, p. 178.
" " ! VERRILL, 1871. Notes Radiata, p. 571.
Eupatagus " D'ARCH. HAIME, 1854. An. foss. Inde, p. 217.
Plagionotus **Desorii** ! GRAY, 1855. Cat. Rec. Echin., p. 51.
" *Desorii* ! DUJ. HUPÉ, 1862. Échin., p. 606.
" " ! PERRIER, 1869. Pédic, p. 178.
" ? **Holmesii** McCRADY, 1857. Plioc. foss. So. Ca., p. 9, *Pl. III. f. 2.*
" **Ravenellianus** McCRADY, 1857. Plioc. foss. So. Ca., p. 9, *Pl. III. f. 3.*

*Tampa Bay (W. Stimpson); *W. India Islands; Mexico! (Mus. Copenh.); Littoral, fragments 115 fms. Florida Gulf Stream (Pourtalès).

Metalia sternalis

Spatangus *Brissus maculosus ventricosus* ! KLEIN, 1734. Nat. Disp. Ech., *Pl. XXVI. f. A.*
Spatangus " " LESKE, 1778. KL. Add., *Pl. XXVI. f. A.* (pars.)
..... GUALTERI, 1742. Ind. Test., *Pl. CIX. f. B; Pl. CVIII. f. G.*
Spatangus **sternalis** ! LAMK. 1816. An. s. Vert., p. 31. So. Pacific.
" *sternalis* DESML. 1837. Syn., p 388.
" " ! AGASS. 1836. Prod., p. 184.
Brissus " ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII., p. 13.
" " ! DUJ. HUPÉ, 1862. Échin., p. 605.
" " ! MART. 1866. Wieg. Arch., I. p. 182. Red Sea.
Bryssus " ! MART. 1869. Decken's Reise, p. 128, *Pl. I. f. 1.* Zanzibar.
Metalia " GRAY, 1855. Cat. Rec. Ech., p. 51. Mauritius.
Brissus **bicinctus** ! VAL. 1847. C. R. Ann. Sc. Nat, VIII. p. 13. Red Sea.
" *bicinctus* ! GRAY, 1855. Cat. Rec. Ech., p. 55.
" " ! DUJ. HUPÉ, 1862. Échin., p. 605.
" **areolatus** ! VAL. 1847 in AGASS. C. R. Ann. Sc. Nat., VIII. p. 13. So. Pacific.
" *areolatus* ! GRAY, 1855. Cat. Rec. Ech., p. 53.
" " ! DUJ. HUPÉ, 1862. Échin., p. 606.
Xanthobrissus Garetti ! A. AGASS. 1863. Bull. M. C. Z., I. p. 28. Kingsmills Islands.
Metalia Garetti ! VERRILL, 1867. Notes Radiata.

*Sandwich, *Kingsmills, *Society Islands (Garrett); *Samoa Islands (Mus. Godeff.); *Mauritius (Pike); *Zanzibar (Cheney); South Sea! Isle de France! Bourbon! (J. d. P.); Raines' Inlet! Port Essington! Reef Attagor! Luzon! Osmaga! (Brit. Mus.); Timor, Flores, New Holland (Martens); Philippine Islands! (Semper); New Caledonia! (Crosse); *Red Sea; Siam! (Bonn Mus.); Upolu! (Mus. Godeff.).

MICROCYPHUS.

Cidaris KLEIN, 1734. Nat. Disp. Ech. (pars.)
Microcyphus AGASS. 1841. Anat. Genre Ech. (non AGASS. 1841, Mon. Scut.). (pars.)
Anthechinus A. AGASS. 1863. Proc. A. N. S. Phila.

Microcyphus maculatus

..... GUALTERI, 1742. Index Test., *Pl. CVIII. f. A.*
Microcyphus **maculatus** ! AGASS. 1841. Anat. Genre Ech., p. VIII.
" *maculatus* ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 358.
" " ! DUJ. HUPÉ, 1862. Échin., p. 517.
Microcyphus **Rousseaui** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. *Pl. XV. f. 10.* **Mascate.**
" *Rousseaui* ! DUJ. HUPÉ, 1862. Échin., p. 517.
Anthechinus roseus ! A. AGASS. 1863. Proc. Ac. N. S. Phila., p. 358. Japan.

Ousima (Stimpson, Smithson. Coll.); *Navigator Islands (Hamburg Mus.); **Mascate**! Mayotte Island! (J. d. P.); Australia! (Liverpool Mus.); Molucca (Martens).

Microcyphus zigzag

? **Cidaris bothryoides** KLEIN, 1734. Nat. Disp. Ech., *Pl. XI. f. H* (non AGASS. P. both.).
Microcyphus **zigzag** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 358.
" *zigzag* ! DUJ. HUPÉ, 1862. Échin., p. 517.

*Philippine Islands; *New Holland (Hamburg Mus.); West Australia! Tasmania! (Brit. Mus.).

(SCHIZASTER.) MOIRA.

Spatangus LAMK. 1816. An. s. Vert. (pars.)
Echinocardium GRAY, 1825. Ann. Phil. (pars)
Schizaster AGASS. 1836. Prod. (pars.)
Moera (**Mich.**) 1855. Rev. Mag. Zoöl. non LEACH nec HÜBN.
Moira.

Moira atropos

..... KNORR, 1771. Délic., *Pl. DIII. f. 3.*
..... ENC. MÉTH, *Pl. CLV. f. 9, 11.*
Spatangus **atropos** ! LAMK. 1816. An. s. Vert., p. 32.
" *atropos* ! BLAINV. 1834. Actin., p. 202.
" " DESML. 1837. Syn., p. 384.
Echinocardium *atropos* ! GRAY, 1825. Ann. Phil., p. 8.
Schizaster " ! AGASS. 1836. Prod., p. 18.
Schizaster " ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 22, *Pl. XVI. f. 10.* So. Carolina.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 61.
Moera atropos ! MICH. 1855. Rev. Mag. Zoöl., p. 246.
" " ! DUJ. HUPÉ, 1862. Échin., p. 603.
" " ! A. AGASS. 1863. Bull. M. C. Z., I.
" " ! LÜTK. 1864. Bid., p. 55. W. Indies.
" " ! A. AGASS. 1869. Bull. M. C. Z., I. p. 296. Straits of Florida.
" " ! PERRIER, 1869. Pédic., p. 178.
Schizaster **Lachesis** ! GIR. 1850. Proc. Boston S. N. H., p. 368. Texas.
Moera Lachesis ! MICH. 1855. Rev. Mag. Zoöl., p. 247.
" " ! DES. 1855. Syn. Éch. foss., p. 394.
" " ! DUJ. HUPÉ, 1862. Échin., p. 603.
" " ! PERRIER, 1869. Pédic., p. 178.

*Texas; *Florida (Würdemann); *Charleston, S. C. (Agassiz, Gibbes); *Beaufort, N. C. (Bickmore); Guadeloupe! (Duchassaing, J. d. P.); Littoral to 80 fms. Florida Gulf Stream (Pourtalès).

Moira clotho

Moera **clotho**! MICH. 1855. Rev. Mag. Zoöl., p. 247. Mazatlan.

*Mazatlan (Cotteau); Guayamas! (Mus. Copenh.); *Gulf California (Écol. Min.)

Moira stygia

Moera **stygia**! LÜTK. MS. 1872, in A. AGASS., Bull. M. C. Z., III. Red Sea.

*Red Sea; Zanzibar! (Mus. Copenh.).

NEOLAMPAS.

Neolampas A. AGASS. 1869. Bull. M. C. Z., I.

Neolampas rostellata

Neolampas rostellatus! A. AGASS. 1869. Bull. M. C. Z., I. p. 271. Straits of Florida.

*Off Sand Key, Florida, 112 fms., *off Samboes, 125 fms. (Pourtalès).

(ECHINOBRISSUS.) NUCLEOLITES.

Nucleolites EDW. 1836. CUV. Règ. An. Ed. Ill.
Echinobrissus DUJ. HUPÉ, 1862. Échin.
Echinobrissus D'ORBIG. 1854. Rev. Mag. Zoöl. (pars.)
Nucleolites DESOR, 1857. Syn. Ech. foss.
Nucleolus MART. 1866. Wieg. Archiv.

Nucleolites epigonus

Nucleolites **epigonus**! MART. 1865. Monatsb. Ak. Berlin, März., p. 143. Flores.
Nucleolus *epigonus*! MART. 1866. Wieg. Arch, p. 179.
" " MART. 1867. Wieg. Arch., I. *Pl. III. f. 13.*

*M. C. Z.; Flores, Java, Timor! (Martens); Lord Hood's Island! (Brit. Mus.).

PALEOSTOMA.

Leskia (**Gray**) 1851. Ann. Mag. N. H., VII (non ROB. DES. 1830.)
Paleostoma LOVÉN, 1867. Vetensk. Ak. Förhdl.

Paleostoma mirabilis

Leskia **mirabilis**! GRAY, 1851. Ann Mag N. H., VII. p. 134. Luzon.
Leskia mirabilis! GRAY, 1855. Cat. Rec. Ech., p. 63, *Pl. IV. f. 4.*
" " DUJ. HUPÉ, 1862. Échin., p. 600.
" " ! A. AGASS. 1863. Proc. A. N. S. Phila., p. 360.
Paleostoma *mirabilis*! LOVÉN, 1867. Vetensk. Ak. Förhdl., No. 5, p. 432, *f. 1, 2.* Singapore.

*Singapore, Batavia (Kinberg, Mus. Stockh.); Hong Kong! (W. Stimps., Smithson. Coll.); Luzon! (Brit. Mus.).

(ECHINOMETRA.) PARASALENIA.

Parasalenia A. AGASS. 1863. Bull. M. C. Z., I.
Echinometra LÜTK. 1864. Bid. (pars.)
Cladosalenia A. AGASS. MS.

Parasalenia gratiosa

Parasalenia gratiosa ! A. AGASS. 1863. Bull. M. C. Z., I. p. 22. Kingsmills and Society Isl'ds.
Echinometra **arbacia** ! LÜTK. 1864. Bid., p. 152, *Pl. I. f. 9.*

*Kingsmills Islands, *Society Islands (Garrett); *Bonin Islands (Stimpson, Smithson. Coll.); *New Caledonia (Crosse); ?New Guinea ! (Mus. Copenh.); Tongatabu ! (Mus. Godeff.); *Zanzibar (Cooke); *Feejee Islands (Mus. Godeff.).

(LAGANUM.) PERONELLA.

Scutella BLAINV. 1827. Dict. S. N. Scut. (pars.)
Lagana LESS. 1834, in BLAINV. Actin. (pars.)
Laganum LESS. 1841, in AGASS. Mon. Scut. (pars.)
Peronella GRAY, 1855. Cat. Rec. Echin.
Rumphia DES. 1857. Syn. Éch. foss.
Polyaster MICH. 1859. Rev. Mag. Zoöl. (non GRAY, 1840).
Michelinia DUJ. HUPÉ, 1862. Échin. (non KON. 1842).
Rumphia A. AGASS. 1863. Bull. M. C. Z.

Peronella decagonalis

Scutella **decagonalis** ! LESS. 1827. Dict. S. Nat. Scut., p. 229.
Lagana **decagona** ! LESS. 1834, in BLAINV. Actin., p. 215, *Pl. XVIII. f. 3.*
" *decagona* ! EDW. in CUV. Règ. An. Ed Ill., *Pl. XV. f. 4.*
" " DESML. 1837. Syn., p. 230.
Laganum decagonum ! LESS. 1841. AGASS. Mon. Scut, 112, *Pl. XXIII. f. 16–20.*
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 132. Waigiou.
" " ! GRAY, 1855. Cat. Ech., p. 12.
" " ! DUJ. HUPÉ. 1862. Éch., p. 560.
" " ! MARTENS, 1866. Wieg. Arch., p. 173. Makao.
Laganum **Lesueuri** VAL. 1841, in AGASS. Mon. Scut., p. 116, *Pl. XXIV. f. 3–6.*
" *Lesueuri* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 9. China.
" " ! DUJ. HUPÉ. 1862. Échin., p. 560.
Rumphia " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 25. Hong Kong.
Polyaster **elegans** ! MICH. 1859. Rev. Mag. Zoöl., No. 9, *Pl XIV. f. 1.*
Michelinia elegans ! DUJ. HUPÉ, 1862. Échin., p. 561.
Laganum **elongatum** AGASS. 1841. Mon. Scut., p. 117, *Pl. XXIV. f. 1, 2.*
" *elongatum* AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " DUJ. HUPÉ, 1862. Échin., p. 560.
" **australe** ! GRAY, MS., (Brit. Mus.)

*Hong Kong (Putnam); *New Caledonia (Crosse); Australia ! Freemantle Bay ! (Brit. Mus.); Japan ! (Mus. Copenh.); Gaspar Straits ! 12 fms. (Liverpool Mus.); Philippine Islands ! (Semper); Bay of Bengal ! (Berlin Mus.).

Peronella orbicularis

..... BREYN. 1732. *Pl. VI. f. 1, 2.*
Laganum *Schynovetti*..... KLEIN, 1734. Nat. Disp. Ech., p. 125.
..... GUALTERI, 1742. *Pl. CX. f. B*, copied in Enc. Méth., *Pl. CXLVII. f. 1, 2.*
Echinodiscus **orbicularis** LESKE, 1778. KL. Add., p. 144, *Pl. XLV. f. 6, 7.*
" *orbicularis* GRAY, 1825. Ann. Phil., p. 11.
" " BLAINV. 1834. Actin., p. 218.
Echinus " GMEL. 1788. Syst. Nat.
Laganum orbiculare ! AGASS. 1841. Mon. Scut., p. 120, *Pl. XXII. f. 16–20* (non Sc. orbic. LAMK.). Batavia.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 11.
" " ! DUJ. HUPÉ, 1862. Échin., p. 560.
" **marginale** ! AGASS. 1841. Mon. Scut., p. 121, *Pl. XXII. f. 11–15* (non Cat. Rais.).

*M. C. Z.; New Holland! (Mus. Copenh.); Formosa! (Mus. Godeff.).

Peronella Peronii

Laganum **Peronii** ! AGASS. 1841. Mon. Scut., p. 123, *Pl. XXII. f. 21–24.* So. Pacific.
" *Peronii* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
Peronella " ! GRAY, 1855. Cat. Rec. Ech., p. 13. New S. Wales.
Rumphia " DES. 1857. Syn. Éch. foss., p. 229.
Rumphia " ! DUJ. HUPÉ, 1862. Échin., p. 561.
Scutella orbicularis ! (**Lamk.**) 1816. An. s. Vert., p. 11 (non Ech. orb. LESKE).
" " ! DESML. 1837. Syn., p. 232.
Lagana " ! BLAINV. 1827. Dict. Sc. N., p. 197 (non Lag. orb. AGASSIZ).
" " ! BLAINV. 1834. Actin., p. 215, *Pl. XVIII. f. 2.*
Laganum **stellatum** ! AGASS. 1841. Mon. Scut., p. 122, *Pl. XXII. f. 7–10.* New S. Wales.
" *stellatum* GRAY, 1855. Cat. Rec. Echin., p. 9. Australia.
" " DUJ. HUPÉ, 1862. Échin., p. 560.

*Australia; *Philippine Islands (Liverpool Mus.); Tasmania! (Liverpool Mus.); Brisbane Water! (Brit. Mus.).

Peronella rostrata

Laganum **rostratum** ! AGASS. 1841. Mon. Scut., p. 118, *Pl. XXV.*
" *rostratum* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 132.
" " ! GRAY, 1855. Cat. Rec. Echin., p. 9. New Zealand.
" " ! DUJ. HUPÉ, 1862. Échin., p. 561.
Rumphia *rostrata* DESOR, 1857. Synops. Éch. foss., p. 229.

*M. C. Z.; New Zealand! Zanzibar! (J. d. P.).

(CIDARIS.) PHYLLACANTHUS.

Cidaris KLEIN, 1734. Nat. Disp. Echin. (pars.)
Cidarites LAMK. 1816. An. s. Vert. (pars.)
Phyllacanthus BRANDT, 1835. Prod. Descrip. (pars.)
Leiocidaris DES. 1854. Synops. Échin. foss.
Rhabdocidaris DES. 1854. Syn. Éch. foss.
Goniocidaris GRAY, 1855. Proc. Zoöl. Soc. London. (pars.)
Prionocidaris A. AGASS. 1863. Bull. M. C. Z., I.
Chondrocidaris A. AGASS. 1863. Bull. M. C. Z., I.

Phyllacanthus annulifera

Cidarites **annulifera** ! LAMK. 1816. An. s. Vert., p. 57. New Holland.
" *annulifera* DESLONG. 1824. E. M, II. p. 196.
" " DESML. 1837. Syn., p. 326.
Cidaris " ! AGASS., 1836. Prod., p. 21.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 327.
" " ! DUJ. HUPÉ, 1862. Éch., p. 471.
" " ! PERRIER, 1869. Pédic., p. 127.
" **ornata** !? GRAY, 1855. Proc. Zoöl. Soc. Lond., p. 37.
" **annulata** ! GRAY, 1855. Proc. Zoöl. Soc., p. 37 (non A. AGASS.).
" **circinnata** ! MART. 1866. (MS. Amst. Mus.) Wieg. Arch., p. 147. Malacca.
" **rosaceus** ! ROUSSEAU, 1869, in PERRIER, Pédic., p. 129, *Pl. III. f. 9.* So. Pacific.

*Australia ! (Liverpool Mus.); *M. C. Z.; Philippine Islands ! (Semper); Malacca ! Oceanie ! (J. d. P.).

Phyllacanthus baculosa

Cidarites **pistillaris** ! LAMK. 1816. An. s. Vert., p. 55. Isle de France.
" *pistillaris* DESLONG. 1824. E. M., *Pl. CXXXVII.*
" " DESML. 1837. Syn., p. 324.
Cidaris " AUDOUIN, Savigny Égypte Échin., *Pl. VII. f. 1.*
" " ! BLAINV. 1834. Actinol., p. 231.
" " ! AGASS. 1836. Prod., p. 21.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 327. Seychelles.
" " ! DUJ. HUPÉ, 1862. Échin, p. 471.
Goniocidaris pistillaris ! GRAY, 1855. Proc. Zoöl. Soc. Lond., p. 35.
Prionocidaris *pistillaris* ! A. AGASS. 1863. Bull. M. C. Z., I. p. 18. Zanzibar.
Cidarites **baculosa** ! LAMK. 1816. An. s. Vert., p. 55.
" *baculosa* DESML. 1837. Syn., p. 324.
" " ! MICH. 1845. Rev. Mag. Z., p. 16, *Pl. IV. f. 1–8.*
Cidaris " ! AGASS. 1836. Prod., p. 21.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 327. Red. Sea.
" " ! DUJ. HUPÉ, 1862. Échin., p. 471.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17.
" " ! MART. 1866. Wieg. Arch., I. p. 144. Mozambique. Amboina Flores.
" " ! PERRIER, 1869. Pédic., p. 126, *Pl. III. f. 1, 3, 4.*
Cidarites **papillaris** ! MICH. 1845. Rev. Mag. Zoöl., p. 16. Isle de France.
Cidaris **Lima** ! VAL. 1846. AGASS. DES. C. R. Ann. Sc. Nat., VI. p. 327. Bourbon.
" *Lima* ! DUJ. HUPÉ, 1862. Échin, p. 472.
" **Krohnii** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 327. Seychelles.
" *Krohnii* ! DUJ. HUPÉ, 1862. Échin., p. 472.

*Red Sea (Botta); *Tor (Frauenfeld); *Zanzibar (Cook); *Bourbon; *Isle de France; Mauritius ! Seychelles ! (J. d. P.).

Phyllacanthus dubia

Phyllacanthus dubia BRANDT, 1835. Prod., p. 268. Bonin.
Phyllacanthus dubia ! A. AGASS. 1863. Proc. A. N. S. Phila., p. 353.
Cidarites " DESML. 1837. Syn., p. 326.
Phyllacanthus imperialis ! A. AGASS. 1863. Bull. M. C. Z., I. p. 17 (non BRANDT.). N. Holland.
Cidaris **canaliculatus** ! ROUSSEAU, 1869. PERRIER, Pédic., p. 189, *Pl. III. f. 5.* Red Sea.

*Zanzibar (C. Cook, Cheney, Ropes); *Bonin Islands (W. Stimpson); Red Sea ! (J. d. P.); New Caledonia ! (Écol. Min.); New Holland ! (Phila. Acad.).

Phyllacanthus gigantea

Chondrocidaris gigantea ! A. AGASS. 1863. Bull. M. C. Z., I. p. 18. Sandwich Islands.

*Sandwich Islands (Garrett).

Phyllacanthus imperialis

Cidaris Mauri ..... ! KLEIN, 1734. De Echin., *Pl. VII. f. A, B, C.*
Echinometra altera digitata SEBA, 1758. Thes., III. *Pl. XIII. f. 3.*
..... KNORR, 1771. Délic., *Pl. D. f. 2.*
Cidaris papillata major LESKE, 1778. KLEIN, Add., p. 126, *Pl. VII. f. A*, copied in DESLONG., Enc. Méth., *Pl. CXXXVI. f. 8; Pl. CXXXIX. f. 9.*
Echinus **cidaris** LIN. 1758. Syst. Nat. (pars.)
" *cidaris* GMEL. 1788. LIN. Syst. Nat., 3174. (pars.)
Cidarites **imperialis** ! LAMK. 1816. An. s. Vert., p. 54. Red Sea.
" *imperialis* DESML. 1837. Syn., p. 318.
Cidaris " ! GRAY, 1825. Ann. Phil., p. 4.
" " ! BLAINV. 1834. Actinol., p. 231.
" " ! AGASS. 1836. Prod., p. 21.
" " PHIL. 1845. Wieg. Arch., I. p. 353.
" " ! AGASS. 1846. Ann. Sc. Nat., VI. p. 326.
" " ! MART. 1866. Wieg. Arch., I. p. 147. Amboina. Molucca.
Phyllacanthus *imperialis* BRANDT, 1835. Prod., p. 268 (non A. AGASS.).
Leiocidaris " DES. 1854. Syn. Éch. foss., p. 48.
Leiocidaris " ! DUJ. HUPÉ, 1862. Échin., p. 482.
" " ! PERRIER, 1869. Pédic., p. 129.
Phyllacanthus **fustigera** ! BARN. 1863, in A. AGASS. Syn. Proc. A. N. S Phila., p. 353. Polar Seas.
Cidaris fustigera MART. 1866. Wieg. Arch.
" **Gaimardii** ROUSS. (MS. J. d. P.).

*Red Sea (J. d. P.); *Gaspar Straits (Stimpson, Smithson. Coll.); *E. India; New Holland! Aru Islands! (J. d. P.); Zanzibar! (Brit. Mus.); Tonga! (Mus. Godeff.); Sulu Sea! (U. S. Ex. Exped. Smithson. Coll.); Molucca (Amsterd. Mus. Martens).

Phyllacanthus verticillata

Cidarites **verticillata** ! LAMK. 1816. An. s. Vert., p. 56.
" *verticillata* DESLONG. 1824. Enc. M., *Pl. CXXXVI. f. 2, 3.*
" *verticillata* DESML. 1837. Syn., p. 324.
Cidaris " ! AGASS. 1836. Prod., p. 21.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI p. 327. So. Pacific.
" " GRIFFITH, CUV. An. Kingd., *Pl. XIII. f. 1.*
" " ! GRAY, 1855. Proc. Zoöl. Soc. Lond., p. 37.
" " ! DUJ. HUPÉ, 1862. Échin., p. 472.
" " ! MART. 1866. Wieg. Arch., I. p. 141. Flores. Timor.
" " ! PERRIER, 1869. Pédic., p. 128, *Pl. III. f. 7.*

*Society Islands! (Garrett); *So. Seas (J. d. P.); *Samoa (Mus. Godeff.); *Lorentuka (Martens); Molucca! (Mus. Berl.); New Holland! (J. d. P.); Feejee! Sandwich Islands! (Mus. Godeff.); Mindoro! (Brit. Mus.).

PHYMOSOMA.

Cyphosoma **(Agass.)** 1840. Cat. Syst. Ectyp. (non MANN. 1837).
Phymosoma HAIME, 1853 D'ARCH. HAIME, An. foss. d'Inde.
Coptosoma DES. 1855. Synops. Éch. foss
Glyptocidaris A. AGASS. 1863. Proc. Acad. N. S. Phila.

Phymosoma crenulare

Glyptocidaris crenularis ! A. AGASS. 1863. Proc. Acad. N. S. Phila., p. 356. Hakodadi.

*Hakodadi (W. Stimpson, Smithson. Coll.).

PLATYBRISSUS.

Platybrissus GRUBE, 1865. Jahresb. d. Schles. Ges. f. Vaterl. Cult.

Platybrissus Roemeri

Platybrissus Roemeri ! GRUBE, 1865. Jahresb. d. Schles. Ges. f. Vaterl. Cult., p. 61.

*M. C. Z.

(TEMNOPLEURUS.) PLEURECHINUS.

Pleurechinus AGASS. 1841. Mon. Scut.
Pleurechinus AGASS. 1841. VAL. An. Genre Ech.
Temnopleurus AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Opechinus DES. 1855. Synop. Éch. foss.

Pleurechinus bothryoides

Pleurechinus *bothryoides* ! AGASS. 1841. Mon. Scut.
Pleurechinus bothryoides ! AGASS. 1841. VAL. Anat. Gen Ech., p. VIII. (non *Cid.* **both.** KLEIN).
Temnopleurus bothryoides ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 360. (pars.)

? Galapagos ! (Écol. Min.).

PODOCIDARIS.

Podocidaris A. AGASS. 1869. Bull. M. C. Z., I.

Podocidaris sculpta

Podocidaris sculpta ! A. AGASS. 1869. B. M. C. Z., I. p. 258. Straits of Florida.

*Doublehead Shot Key, Fla., 315 fms., *Florida Gulf Stream, 120, 138, 154 fms. (Pourtalès).

POROCIDARIS.

Porocidaris DES. 1854. Syn. Échin. foss.

Porocidaris purpurata

Porocidaris **purpurata** ! W. THOMS. 1869. Prel. Rep. Porcup. Exp. P. R. S.

*Deep water between Rona and Rockall (Porcup. Exp.).

POURTALESIA.

Pourtalesia A. AGASS. 1869. Bull. M. C. Z., I.

Pourtalesia miranda

Pourtalesia miranda ! A. AGASS. 1869. Bull. M. C. Z., I. p. 272. Straits of Florida.

*Florida Gulf Stream, 349 fms. (Pourtalès); off Rockall, 1215 fms., Shetland Channel ! (Porcupine Exped.).

(STRONGYLOCENTROTUS.) PSEUDOBOLETIA.

Boletia A. AGASS. 1863. Bull. M. C. Z., I. (pars.)
Pseudoboletia TROSCH. 1869. Verhdl. d. Nat. Ver Rheinl. u. West.

Pseudoboletia granulata

Boletia **granulata** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 24. Sandwich Islands.
Pseudoboletia stenostoma ! TROSCH. 1869. Verhandl. Nat. Ver. Rheinl. u. West., p. 96.

*Sandwich Islands (Garrett).

Pseudoboletia indiana

Toxopneustes **indianus** ! MICH. 1862. MAILL. Bourbon, Ann. A., p. 5. Bourbon.
Sphaerechinus *indianus* LÜTK. 1864. Bid.
Pseudoboletia maculata ! TROSCH. 1869. Verhandl. Nat. Ver. Rheinl. u. West., p. 96.

*M. C. Z.; Masbate! Philippine Islands! Mauritius! (Brit. Mus.); *Isle de France; Bombay! (Écol. Min.); Bourbon! (Loriol).

(CASSIDULUS.) RHYNCHOPYGUS.

Echinobrissus BREYN. 1732. Schedias. (pars.)
Cassidulus LAMK. 1801. An. s. Vert.
Nucleolites DESML. 1837. Syn. (pars.)
Pygorhynchus AGASS. 1860. Proc. Bost. Soc. N. H.
Rhynchopygus LÜTK. 1864. Bid.
Rhyncholampas A. AGASS. 1869. Bull. M. C. Z., I.

Rhynchopygus caribaearum

Cassidulus caribaearum ! LAMK. 1801. An. s. Vert., p. 349. W. Indies.
Cassidulus caribaearum ! GRAY, 1855. Cat. Rec. Echin., p. 34.
" " ! LÜTK. 1864. Bid., p. 126, *Pl. II. f. 6.*
Rhynchopygus " ! LÜTK. 1864. Bid. Append, p. 1. St. Thomas.
Rhyncholampas *caribaearum* ! A. AGASS. 1869. Bull. M. C. Z., I. p. 270.
Cassidulus **australis** ! LAMK. 1816. An. s. Vert., p. 35. (pars.)
" *australis* ! BLAINV. 1834. Actin., p. 210.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 157.
" " ! DUJ. HUPÉ, 1862. Échin., p. 582.
" " ! PERRIER, 1869. Pédic., p. 170.
" **Richardii** DESLONG. 1824. Enc. Méth., *Pl. CXLIII. f. 8, 9, 10.*
Nucleolites Richardii DESML. 1837. Syn., p. 354. (pars.)
" " ! DUCH. 1850. Rad. d. Antilles.
Cassidulus **guadeloupensis** ! DUCH. 1847. Bull. Soc. Géol. Fr. Guadeloupe.
Rhynchopygus guadeloupensis DES. 1857. Syn. Éch. foss., p. 288.

*St. Thomas (Riise); Jamaica! (Mus. Copenh.); Guadeloupe! (Duchassaing, J. d. P.).

Rhynchopygus pacificus

Pygorhynchus **sp.** ! AGASS. 1860. Proc. Boston Soc. N. H., p. 262. Acapulco
" **pacificus** ! A. AGASS. 1863. Bull. M. C. Z., I. p. 27.
" *pacificus* ! VERRILL, 1867. Notes Radiata, p. 315. Cape St. Lucas.
" " ! PERRIER, 1869. Pédic., p. 170.
Rhyncholampas *pacificus* ! A. AGASS. 1869. Bull. M. C. Z., I. p. 270.

*Acapulco (A. Agass., Van Brunt); *Panama (Jewett); Cape St. Lucas! (Xanthus, Smithson. Coll.); Galapagos! (Mus. Stockholm).

(HEMIASTER.) RHYNOBRISSUS.

Rhynobrissus A. AGASS. 1872. Bull. M. C. Z., III

Rhynobrissus pyramidalis

Rhynobrissus pyramidalis A. AGASS. 1872. Bull. M. C. Z., III. China Seas.

*Sea of Linguin, China Seas (Liverpool Mus.).

ROTULA.

Echinodiscus BREYN. 1732. Schedias. (pars.)
Rotula KLEIN, 1734. Nat. Disp. Echin.
Placenta BRISSON, 1754. KL. Ed. Gall.
Scutella LAMK. 1816. An. s. Vert. (pars.)
Echinodiscus GRAY, 1825. Ann. Phil. (pars.)
Heliophora AGASS. 1840. Cat. Syst. Ectyp.
Rotula AGASS. 1841. Mon. Scut.
Echinodiscus D'ORBIG. 1854. Rev. Mag. Zoöl.
" DES. 1857. Synops. Ech.

Rotula Augusti

Echinodiscus ..... BREYN. 1732. *Pl. VII. f. 5, 6.*
..... GUALTERI, 1742. *Pl. CX. f. H.*
Echinus alterplanus ..... SEBA, 1758. Thes., III. *Pl. XV. f. 17, 18.*
Rotula Augusti ! KLEIN, 1734. Nat. Disp. Ech., *Pl. XXII. f. C, D*, copied, Enc. M., *Pl. CL. f. 5, 6.*
Rotula Augusti ! AGASS. 1841. Mon. Scut., p. 28, *Pl. II. f. 1–10; Pl. IV a. f. 1–6.* W. coast Africa.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 138.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 17.
" " DESOR, 1857. Synop. Ech. foss.
" " ! DUJ. HUPÉ, 1862. Ech., p. 570.
" " BRONN, 1859. KL. u. Ord. Actin., *Pl. XLI. f. 14.*
Echinodiscus **deciesdigitatus** LESKE, 1778. KL. Add., p. 145, *Pl. XXII. f. A, B.*
" **octiesdigitatus** ! LESKE, 1778. KL. Add., p. 147, *Pl. XXII. f. C, D*, copied in Enc. M., *Pl. CL. f. 3, 4.*
Echinus **octodactylus** GMEL. 1788. LINN. Syst. Nat., 3191.
Scutella octodactyla ! BLAINV. 1825. D. S. N. Scut., p. 227.
" " ! AGASS. 1836. Prod., p. 188.
" " ! BLAINV. 1834. Actin, p. 220.
" " DESML. 1837. Syn., p. 222.
" " EDW. in CUV. Règ. An. Ed. III., *Pl. XV. f. 2.*
Echinodiscus octodactylus ! GRAY, 1825. Ann. Phil., p. 6.
Placenta **rotula** BRISSON, 1754. KLEIN, Ed. Gall., p. 94, *Pl. XII. f. A, B.* (pars.)
Scutella digitata ! LAMK. 1816. An. s. Vert., p. 8.
Scutella digitata ! AGASS. 1836. Prod., p. 188.
Echinodiscus digitatus ! GRAY, 1825. Ann. Phil., p. 6.
Scutella **decadactyla** ! BLAINV. 1827. D. S. N. Scut., p. 227.
" *decadactyla* ! BLAINV. 1834. Actin., p. 220.
" " DESML. 1837. Syn., p. 222.
Rotula **Gualteri** GRAY, 1855. Cat. Rec. Ech., p. 18.

*Liberia; *Cape Palmas; *W. coast Africa.

Rotula Rumphii

..... RUMPH. 1705. *Pl. XIV. f. 1.*
Echinus planus ..... SEBA, 1758. Thes., III. *Pl. XV. f. 15, 16, 19, 20*, copied, ENC. M., *Pl. CLI. f. 3, 4.*
Echinodiscus dimidia ..... BREYN. 1732. Sched., p. 64, *Pl. VI. f. 3, 4.*
Rotula Rumphii ! KLEIN, 1734. Nat. Disp. Ech., *Pl. XXII. f. E, F*, copied in ENC. M., *Pl. CLI. f. 1, 2.*
Rotula Rumphii ! AGASS. 1841. Mon. Scut., p. 25.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 138.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 17.
Echinodiscus Rumphii ! DES. 1857. Syn. Éch. foss., p. 238 (non BLAINV.).
" " ! DUJ. HUPÉ, 1862. Échin., p. 570.
Placenta **rotula** BRISSON, 1754. KLEIN, Ed. Gall., p. 196. (pars.)
Echinodiscus **dentatus** LESKE, 1778. KLEIN, Add., § 96, *Pl. XXII. f. E, F; Pl. XLIX.* copied from SEBA.
" *dentatus* ! GRAY, 1825. Ann. Phil., p. 6.
Scutella *dentata* ! LAMK. 1816. An. s. Vert., p. 8.
Scutella " ! BLAINV. 1827. D. S. N. Scut., p. 226.
" " ! BLAINV. 1834. Actin., p. 220.
" " ! AGASS. 1836. Prod., p. 188.
" " DESML. 1837. Syn., p. 220.
? *Echinus* **orbiculus** GMEL. 1788. LINN. Syst. N., 3192 (an Mell. testudinata?)
Scutella **semisol** BLAINV. 1827. D. S. N. Scut, p. 227.
" *semisol* DESML. 1837. Syn., p. 220.
" **radiata** BLAINV. 1834. Actin., p. 220.
" *radiata* AGASS. 1836. Prod., p. 188.
Rotula **digitata** ! AGASS. 1841. Mon. Scut., *Pl. I.* Senegal.
" *digitata* ! AGASS. 1847. C. R. Ann. Sc. Nat., VII. p. 138. (pars.)
Echinodiscus digitatus ! DES. 1857. Syn. Éch. foss., p. 238.
Rotula **Kleinii** ! MICH. MS. (Écol. Min.)

*Senegal; *Cape Verde Islands (Bouvier); Loando! (Écol. Min.); Porto Praya, 20 fms.! (W. Stimpson, Smithson. Coll.).

SALENIA.

Salenia GRAY, 1835. Proc. Z. S. London.
Cidarella DESML. 1837. MS. Et. Echin., p. 207.
Salenocidaris A. AGASS. 1869. Bull. M. C. Z., I.

Salenia varispina

Salenocidaris varispina ! A. AGASS. 1869. Bull. M. C. Z., I. p. 254. Straits of Florida.

*Off Doublehead Shot Key, 135 fms. (Pourtalès).

SALMACIS.

Salmacis AGASS. 1841. VAL. An. Genre Ech.
Salmacis AGASS. 1846. C. R. Ann. Sc. Nat., VI.
Melobosis GIR. 1850. Proc. Bost. Soc. N. H.
Toreumatica GRAY, 1855. Proc. Zoöl. Soc. London. (pars.)
Melebosis (err. typ.) DUJ. HUPÉ, 1862. Échin.
Diploporus TROSCH. MS. 1866. MART. Wieg. Arch.

Salmacis bicolor

Salmacis bicolor ! AGASS. 1841. VAL. Anat. Genre Ech., p. 8.
Salmacis bicolor ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 359, *Pl. XV. f. 4.* Bombay. Red Sea.
" " ! DES. 1855. Synops. Éch. foss., p. 109, *Pl. XVII. f. 12.*
" " BRONN, 1859. Kl. u. Ord. Actin., *Pl. XLII. f. 8.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 515.
" " ! PERRIER, 1869. Pédic., p. 139.

*Red Sea; *Zanzibar (Webb, Ropes); *Mauritius (Pike); Bombay ! (Mus. Paris); Mozambique ! (Mus. Berl.).

Salmacis Dussumieri

Salmacis **Dussumieri** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 359. Singapore. China Seas.
Toreumatica concava ! GRAY, 1855. Proc. Zoöl. Soc. London, p. 39 (non A. AGASS.). Hong Kong.
Salmacis **Desmoulinsii** ! DUJ. HUPÉ, 1862. Échin., p. 516.
Temnopleurus **elegans** ! MICH. MS. Écol. Min.

*M. C. Z; Singapore ! China Seas ! (J. d. P., Écol. Min.); Philippine Islands ! (Semper); Hong Kong (Brit. Mus.).

Salmacis globator

Salmacis **globator** ! AGASS. 1846. C. R. An. Sc. Nat., VI. p. 359.
" *globator* ! DUJ. HUPÉ, 1862. Échin, p. 516.

*Australia; E. and W. coast Australia ! (Brit. Mus.).

Salmacis rarispina

Salmacis **rarispinus** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 359. Malacca. Singapore.
" *rarispinus* ! DUJ. HUPÉ, 1862. Échin., p. 516.
Melobosis " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 24.
Salmacis **varius** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 359. Singapore.
" *varius* ! DUJ. HUPÉ, 1862. Échin., p. 516.
" **pyramidata** ! TROSCH. 1866, in MART. Wieg. Archiv, I. p. 159. (pars.) Timor.
" **festivus** ! GRUBE, 1867. Schles. Ges. f. Vat. Cult. Siam.
" **rubrotinctus** ! GRUBE, 1867. Schles. Ges. f. Vat. Cult.
Melobosis **intermedius** ! GIR. MS. M. C. Z.

*Philippine Islands (Cotteau); Timor ! (Martens); Shanghae ! (Amherst Coll.); Malacca ! Singapore ! (J. d. P.); Philippine Islands ! (Semper Coll.); Tranquebar ! (Mus. Copenh.); Bondy Head ! (Brit. Mus.); *Siam (Salmin); Cape York ! Banca Straits ! (Salmin).

Salmacis sulcata

Salmacis **sulcatus** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 359. E. India.
" *sulcatus* ! DUJ. HUPÉ, 1862. Échin., p. 516.
" **virgulatus** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 359. Ceylon.
" *virgulatus* ! DUJ. HUPÉ, 1862. Échin., p. 516.
Melobosis mirabilis ! GIR. 1850. Proc. Boston S. N. H., III. p. 365.
Melebosis *mirabilis* ! DUJ. HUPÉ, 1862. Échin., p. 516.
Salmacis **conica** ! MART. 1866. Wieg. Arch., p. 159.
Diploporus pyramidata ! TROSCH. 1866, in MART. Wieg. Arch., p. 159. (pars.)

*Port Mackay (Mus. Godeff.); *New Holland (Cotteau); *East India; Philippine Islands ! (Semper); China ! (Stockholm Mus.); Ceylon ! (J. d. P.); Banca Straits ! (Salmin); Red Sea ! (Mus. Copenh.); Mozambique ! (Peters).

SCHIZASTER.

Echinus LINN. 1758. Syst. Nat. (pars.)
Spatangus LAMK. 1816. An. s. Vert. (pars.)
Ova GRAY, 1825. Ann. Phil.
Micraster AGASS. 1836. Prod.
Brissus DÜB. o. KOR. 1844. Skand. Echin.
Schizaster AGASS. 1847. C. R. Ann. Sc. Nat., VIII.
Tripylus GRAY, 1851. Ann. Mag.
Nina GRAY, 1855. Cat. Rec. Echin.
Brisaster GRAY, 1855. Cat. Rec. Ech.
Tripylus SARS, 1861. Norges Echin.
Periaster DUJ. HUPÉ, 1862. Échin. (pars.)
Paraster POMEL, 1869. Rev. d. Échin.

Schizaster canaliferus

Echinus **lacunosus** LINN. 1758. Syst. Nat., 665. (pars.)
" *lacunosus* GMEL. 1788. LINN. Syst., 3196. (pars.)
Spatangus " LESKE, 1778. KL. Add.
" **canaliferus** ! LAMK. 1816. An. s. Vert., p. 31.
" *canaliferus* ! BLAINV. 1825. Dict. Sc. N. O , p. 90.
" " ! BLAINV. 1834. Actin., p. 202.
" " DESML. 1837. Syn.. p. 386.
" " ENC. MÉTH., *Pl. CLVI. f. 1–3.*
Ova " ! GRAY, 1825. Ann. Phil., p. 9.
Micraster " ! AGASS. 1836. Prod., p. 17.
Micraster " PHIL. 1845. Wieg. Arch., I. p. 341.
Schizaster " ! AGASS. 1847. C. R. Ann. Sc. N., VIII. p. 20, *Pl. XVI. f. 6.* Mediterranean.
" " MÜLL. 1852. Abhdl., IV. *Pl. VIII. f. 10–13; Pl. VIII. f. 7–10.* (Pluteus.)
" " MÜLL. 1853. Abhdl., VI. *Pl. VII. f. 7–9.*
" " MÜLL. 1854. Bau d. Echin., *Pl. I. f. 6.*
" " MÜLL. 1855. Abhdl., VII. *Pl. V. f. 5, 6; Pl. VII.; Pl. VI.* ? (Pluteus.)
" " SARS, 1857. Middelh. Litt. Fauna, p. 117.
" " ! DES. 1858. Syn. Éch. foss., *Pl. XLIII. f. 1, 2.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 603.
" " ! PERRIER, 1869. Pédic., p. 177.
Nina " ! GRAY, 1855. Cat. Rec. Ech., p. 60.
Schizaster cordatus BRONN, 1859. KL. u. Ord. Actin., p. 341, *Pl. XXXIX. f. 26* (non AUCT.).

*W. coast Italy (Rigacci); *Naples (Panceri); Triest (Sars); Nice (Risso); Venice, Lussin (Grube); Zara, Lessina (Heller).

Schizaster fragilis

Brissus **fragilis** ! DÜB. o. KOR. 1844. Skand. Echin., p. 280, *Pl. X. f. 47, 49.* W. coast Norway.
Schizaster fragilis ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 22.
" " ! LÜTK. 1864. Bid., p. 175.
Brisaster " ! GRAY, 1855. Cat. Rec. Ech., p. 61.
Tripylus " SARS, 1861. Norges Echin., p. 96.
Periaster " ! DUJ. HUPÉ. 1862. Échin., p. 598. Straits of Florida.
Schizaster cubensis ! A. AGASS. 1869. Bull. M. C. Z., I. p. 278 (non D'ORBIG.).

*Lofoten Islands, 100–150 fms. (G. O. Sars); *W. coast Norway (Thomson); Drontheim — Cape North (McAndrew & Barrett); Bergen, Finmark (Sars); Gulf of St. Lawrence (Whiteaves, 250 fms.); *Straits of Florida (Pourtalès).

Schizaster gibberulus

..... AUDOUIN in SAVIGNY, Égypte Zooph., *Pl. VII. f. 5.*
Schizaster **gibberulus** ! AGASS. 1847. C. R. Ann. Mag. N. H., VIII. p. 22. Red Sea.
Periaster *gibberulus* D'ORBIG. 1854. Pal. fr., p. 270.
Periaster " ! DUJ. HUPÉ, 1862. Échin., p. 598.
" " ! PERRIER, 1869. Pédic, p. 177.
Brisaster " ! GRAY, 1855. Cat. Rec. Echin., p. 61.
Paraster " POMEL, 1869. Rev. d. Échin.

*Red Sea.

Schizaster Philippii

Tripylus **Philippii** GRAY, 1851. Ann. Mag. N. H., VII. p. 132.
" *Philippii* GRAY, 1855. Cat. Rec. Echin., p. 59, *Pl. V. f. 1.* So. Am. Straits Magellan.
Brissopsis " DUJ. HUPÉ, 1862. Échin., p. 597.

*M. C. Z.; Statten Land! (Brit. Mus.).

Schizaster ventricosus

Schizaster **ventricosus** ! GRAY, 1851. Ann. Mag. N. H., VII. p. 133. Australia.
Nina *ventricosus* ! GRAY, 1855. Cat. Rec. Echin., p. 60, *Pl. IV. f. 2.*
Schizaster **Jukesii** ! GRAY, 1851. Ann. Mag. N. H., VII. p. 133. Cape York.
Nina *Jukesii* ! GRAY, 1855. Cat. Rec. Echin., p. 61, *Pl. III. f. 4.*

*Feejee Islands (Godeff. Mus); Siam! (Bonn Mus.); Hong Kong! (Vienna, Breslau Mus.); Pelew Islands! (Mus. Godeff.); Philippine Islands! (Semper).

SPATANGUS.

Spatangus KLEIN, 1734. Nat. Disp. Ech.
Spatagus MÜLL. 1776. Prod. Zool. Dan. (pars.)
Spatangus LESKE, 1778. KL. Addit. (pars.)

Spatangus Lütkeni

Spatangus **Lütkeni** ! A. AGASS. 1872. Bull. M. C. Z., III. Cape China.
" *altus* LÜTK. MS.

*Japan (Salmin, Kölliker); Hakodadi! (W. Stimpson, Smithson. Coll.).

Spatangus purpureus

Echinus Spatangus et Brissus RONDEL. 1554. Lib. de piscib. mar., p. 578.
Spatagus purpureus !? MULL. 1776. Prod., 2850; Zool. Dan, *Pl. VI.*
Spatangus purpureus LESKE, 1778. KL. Add., p. 170, *Pl. XLIII. f. 3–5; Pl. XLV. f. 5,* copied in ENC. MÉTH., *Pl. CLVII. f. 1–3.*
" " ! LAMK. 1816. An. s. Vert., p. 29. Atlantic European.
" " ! GRAY, 1825. Ann. Phil., p. 8.
" " FLEM. 1828. Brit. An., p. 489.
" " ! BLAINV. 1834. Actin., p. 202, *Pl. XIV.*
" " ! AGASS. 1836. Prod., p. 17.
" " DESML. 1837. Syn., p. 388.
" " EDW. in CUV. Règ. An. Ed. Ill., *Pl. XIbis. f. 1; Pl. XVII. f. 2.*
" " !? FORBES, 1841. Brit. Starf., p. 182, *f.*
" " DÜB. o. KOREN, 1844. Skand. Ech., p. 285. W. coast Norway.
" " PHIL. 1845. Wieg. Archiv, I. p. 350.
" " ! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 6.
" " ! GRAY. 1848. Brit. Rad., p. 6.
" " ! GRAY, 1855. Cat. Rec. Ech., p. 47.
" " DESOR, 1858. Synops. Éch. foss., *Pl. XLIV. f. 1.*
" " BRONN, 1859. KL. u. Ord. Actin., p. 340, *Pl. XL. f. 21–23.*

Spatangus purpureus (*continued*).

Spatangus purpureus ! Sars, 1861. Norges Ech., p. 99.
" " ! Duj. Hupé, 1862. Échin., p. 607.
" " ! Perrier, 1869. Pédic., p. 178, *Pl. VII. f. a, d, e.*
Echinus " Gmel. 1788. Linn. Syst. Nat.
" " Penn. 1812. Brit. Zoöl., 2d Ed., *Pl XXXVII.; Pl. XXXV.* 1st Ed.
Spatangus **meridionalis** Risso, 1826. Europ. Mérid., V. p. 280 (non Auct. Angl.).
" *meridionalis* ! Blainv. 1834. Actin., p. 202.
" " Phil. 1845. Wieg. Archiv, I., p. 350.
" " ! Agass. 1847. C. R. Ann. Sc. N., VIII. p 6. Mediterranean. Algeria.
" " ! Gray, 1855. Cat Rec. Echin., p. 47.
" " Sars, 1857. Middelh. Litt. faun., p. 1. Naples.
" " ! Duj. Hupé, 1862. Échin., p. 608.
" " ! Perrier, 1869. Pédic., p 190.
" **spinosissimus** ! Agass. 1847. C. R. Ann. Sc. N., VIII. p. 6. European Seas.
" *spinosissimus* ! Gray, 1855. Cat. Rec. Echin., p. 47.
" **Reginae** ! Gray, 1851. Ann. Mag. N. H., VII. p. 130. Malta.
" *Reginae* ! Gray, 1855. Cat. Rec. Echin., p. 47, *Pl. III. f. 1.*

*German Ocean; Oresund; *Dröback (Eschricht); *Lofoten Islands, 20–40 fms. (G. O. Sars); Rochelle! Cherbourg! W. coast France! (J. d. P.); N. & E. Ireland (Thomson); Irish Sea! (Liverpool Mus.); Shetland Islands (Norman); Drontheim — N. Cape (McAndrew & Barrett); *British Seas; Heligoland, Finmark (Sars); Isle of Man, Weymouth (Forbes); Katwijck (Maitland); *Cape Sagras (Porcup. Exped.); *Mediterranean; Naples, Messina (Sars); Malta (Brit. Mus.); Nice (Risso); Zara, Lessina (Heller); Lussin (Grube); *W. coast Italy (Rigacci).

Spatangus Raschi

Spatangus **Raschi** ! Lovén, 1869. Öfv. Skand. Vet. Akad. Förh. German Ocean.
" *meridionalis* (Auct. Anglic.) **Norman** 4th Dredging Rep. Brit. Ass., 1868.

*W. Ireland (Porcupine Exped.); Azores! (Breslau Mus.); Storeggen Bk., 200 fms. (Rasch); Shetland Islands (Barrett, Norman); off Valencia! 110 fms. (Porcupine Exped.).

(STRONGYLOCENTROTUS.) Sphaerechinus.

Echinus Lamk. 1816. An. s. Vert. (pars.)
Toxopneustes Agass. 1846. C. R. Ann. Sc. Nat., VI. (pars.) (non Agass. 1841.)
Sphaerechinus Des. 1857. Synop. Ech. foss.
Sphaeriechinus Lütk. 1864. Bid. (err. typ.)

Sphaerechinus Australiae

Sphaerechinus **Australiae** ! A. Agass. 1872. Bull. M. C. Z., III.
Cryptopora " ! Mich. MS. (Écol. Min.). Australia.
Pachechinus " ! A. Agass. MS. M. C. Z.

*Australia (B. M. Wright); Mauritius! (Écol. Min.); New Zealand! Tasmania! E. coast Australia! Adelaide! (Brit. Mus.)

Sphaerechinus granularis

Echinus **ovarius** Rondel. 1554. Lib. de piscib. marin., p. 578.
" **granularis** ! Lamk. 1816. An. s. Vert., p. 44.
Toxopneustes granularis ! Agass. 1846. C. R. Ann. Sc. Nat., p. 367.
" " ! Duj. Hupé, 1862. Échin., p. 531.
Sphaerechinus " ! A. Agass. 1863. Bull. M. C. Z., I. p. 23. Fayal.
Sphaeriechinus *granularis* Lütk. 1864. Bid., p. 148.

Sphaerechinus granularis (*continued*).

Echinus **brevispinosus** Risso, 1826. Europ. Mérid., V. p. 277. **Mediterranean.**
" *brevispinosus* ! Val. 1841. Anat. Ech., *Pl. I. f. 4–6, 9; Pls. II., VII.* (pars.)
" " Müll. 1852. Abhdl., V. *Pl. VIII. f. 1–9;* VI. *Pl. VIII. f. 3–6;* VII. *Pl. I.* (Pluteus.)
" " Müll. 1854. Bau d. Echin., *Pl. II. f. 5.*
Toxopneustes brevispinosus ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 86. **N. shore Africa.**
" " Sars, 1857. Middelh. Litt. faun , p. 112. **Naples.**
" " ! Duj. Hupé, 1862. Échin., p. 531.
Sphaerechinus " ! Desor, 1857. Synops. Éch. foss., p. 134.
Echinus esculentus ! Blainv. 1825. Dict. Sc. N. O , p. 86 (non Linn.).
" " ! Blainv. 1834. Actin., *Pl. XIX.*
" " Edw. in Cuv. Règ. An. Ed. Ill., *Pl. XI. f 1.*
Sphaerechinus esculentus Bronn, 1859. Kl. u. Ord. Actin., p. 337, *Pl. XXXVII. f. 1–3, 5–14, 16–19; Pl. XXXIX. f. 6.*
Echinus **equituberculatus** ! Blainv. 1825. Dict. Sc. N. O., p. 86 (non p. 76).
" *equituberculatus* ! Blainv. 1834. Actin., p. 228 (non p. 226).
" **aequituberculatus** Desml. 1837. Syn., p. 280.
Toxopneustes " ! Duj. Hupé, 1862. Échin., p. 531.
Echinus **subglobiformis** ! Blainv. 1825. Dict. Sc. N. O., p. 89.
" *subglobiformis* Desml. 1837. Syn., p. 282.
" **dubius** ! Blainv. 1825. Dict. Sc. N. O., p. 87.
" *dubius* ! Blainv. 1834. Actin., p. 228.
" " Desml. 1837. Syn., p. 280.
Toxopneustes **albidus** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 367. **W. coast France.** (pars.).
" *albidus* ! Duj. Hupé, 1862. Échin., p. 531.

***Mediterranean**; ***Madeira** (W. Stimpson, Smithson Coll.); ***Nice** (Verany); ***Naples** (Panceri); ***W. coast Italy** ! (Rigacci); ***Fayal** (Higginson, Dabney); ***Sicily**; **N. coast Africa** ! **Cape Verde Islands** ! **W. coast France** ! (J. d. P.); **Genoa** (Verany); **Messina** (Sars); **Spain, Portugal, W. Africa, Canary Islands** (Forbes); **Venice, Lussin** (Grube); **Lissa, Lessina, Ragusa, E. coast Adriat.** (Heller).

Sphaerechinus pulcherrimus

Psammechinus **pulcherrimus** ! Barn. 1863, in A. Ag. Proc. Acad. N. S. Phila., p. 357. **Hakodadi.**
Holopneustes **complanatus** Herkl, MS. Leyd. Mus. (teste Martens).
Discaster Bernardi Mich. MS. Écol. Min. (Monstrosity.)

***Hakodadi** (W. Stimpson, Smithson. Coll.); **Nagasaki** ! (Martens); **Japan** ! **China Seas** ! (Écol. Min.).

STEPHANOCIDARIS.

Cidarites Lamk. 1816. An. s. Vert. (pars.)
Cidaris Agass. 1836. Prod. (pars.)
Stephanocidaris A. Agass. 1863. Bull. M. C. Z., I.

Stephanocidaris bispinosa

Cidarites **bispinosa** ! Lamk. 1816. An. s. Vert., p. 57. **New Holland.**
" *bispinosa* Desml. 1837. Syn., p. 326.
Cidaris " ! Agass. 1836. Prod., p. 21.
Stephanocidaris *tubaria* ! A. Agass. 1863. Bull. M. C. Z., I. p. 18 (non C. tubaria Lamk.).

***Australia, Malacca** ! (J. d. P.); **Australia** ! (Peron et Les.).

STOMOPNEUSTES.

Echinus LAMK. 1816. A. s. Vert. (pars.)
Stomopneustes AGASS. 1841. Monog. Scut. Int.
Heliocidaris DESML. 1846. AGASS. C. R. Ann. Sc. Nat., VI. (pars.)

Stomopneustes variolaris

..... SEBA, 1758. Thes., III. *Pl. XIII. f. 5, 6.*
Echinus **variolaris** ! LAMK. 1816. An. s. Vert., p. 47. So. Pacific.
" *variolaris* ! BLAINV. 1825. Dict. Sc. Nat. O., p. 90.
" " DESLONG. E. M., *Pl. CXXXV.*
" " BLAINV. 1834. Actin., p. 228.
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn., p. 284.
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 10. Isle de France.
Stomopneustes *variolaris* ! AGASS. 1841. Monog. Scut. Int.
Stomopneustes " AGASS. 1841. VAL. Anat. G. Echin., p. X.
Heliocidaris " DESML. 1847. AGASS. C. R. Ann. Sc. Nat., VI. p. 371.
Heliocidaris " ! DUJ. HUPÉ, 1862. Échin., p. 537.
" " ! PERRIER, 1869. Pédic., p. 158.
Echinus **paucituberculatus** ! BLAINV. 1825. Dict. S. N. O., p. 80.
" *paucituberculatus* ! BLAINV. 1834. Actin., p. 227.
" " DESML. 1837. Syn., p. 274.
Heliocidaris *paucituberculata* ! DESML. 1847. AGASS. C. R. Ann. Sc. Nat., VI. p. 371.
Heliocidaris " ! DUJ. HUPÉ, 1862. Échin., p. 537.
Echinus **anguifer** DESML. 1837. Syn., p. 276.
" **Leschenaulti** ! BLAINV. 1825. D. S. Nat. O., p. 93.
Echinometra Leschenaulti ! BLAINV. 1834. Actin., p. 225.
" " DESML. 1837. Syn., p. 260.

*Mauritius (Pike); *Zanzibar (Cheney); *Samoa (Acad. N. S. Phila.); *Mozambique (Cook); *Calcutta (Theobald); Natal! (Mus. Stutt.); Java! Reunion! (Cotteau).

STRONGYLOCENTROTUS.

Echinus LINN. 1758. Syst. Nat.
" MÜLL. 1776. Prod. Zoöl. Dan. (pars.)
" MOL. 1782. Chili.
Strongylocentrotus BRANDT. 1835. Prod. (pars.)
Toxopneustes AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Echinus AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Heliocidaris DESML. 1846. AGASS. C. R. Ann. Sc. Nat., VI. (pars.)
Echinometra GRAY, 1848. Brit. Rad. (pars.)
Loxechinus DES. 1855. Synops. Échin.
Psammechinus DUJ. HUPÉ, 1862. Échin. (pars.)
Sphaerechinus DUJ. HUPÉ, 1862. Échin. (pars.)
Toxocidaris A. AGASS. 1863. Bull. M. C. Z., I.
Anthocidaris LÜTK. 1864. Bid.
Euryechinus VERRILL, 1866. Proc. Bost. Soc. N. H.
Echinometra PERRIER, 1869. Pédic. (pars.)

Strongylocentrotus albus

Echinus **albus** Mol. 1782. Chili, p. 175. Chili.
" *albus* ! Agass. 1846. C. R. Ann Sc. Nat., VI., p. 368. Callao.
" " Müll. 1854. Bau d. Echin., *Pl. II. f. 2.*
Loxechinus *albus* ! Des. 1855. Syn. Éch. foss., p. 136.
Loxechinus " Bronn, 1859. Kl. u. Ord. Actin., *Pl. XXXIX. f. 9.*
" " ! Duj. Hupé, 1862. Échin., p. 535, *Pl. IX. f. 2.*
Echinus **eurythrogrammus** ! Val. 1846. Voyage Vénus. (pars.)

*Chili, *Mejillones (Putnam); Callao! (J. d. P.); Straits Magellan! (Mus. Stockh.); ? Philippine Islands! (Semper).

Strongylocentrotus armiger

Strongylocentrotus **armiger** A. Agass. 1872. Bull. M. C. Z., III.

*Australia.

Strongylocentrotus depressus

Toxocidaris **depressa** ! A. Agass. 1863. Proc. A. N. S. Phil., p. 356. Niphon.
Echinus **disjunctus** ! Mart. 1866. Wieg. Arch., I. p. 135. Nagasaki.

*N. End Niphon (Stimpson); *Yedo (Dall, Smithson. Coll.); Nagasaki! (Martens).

Strongylocentrotus Dröbachiensis

Echinus **Dröbachiensis** !? Müll. 1776. Prod. Zool. Dan., p. 235. German Ocean. Norway.
Toxopneustes Dröbachiensis ! Agass. 1846. C. R. Ann. Sc. N., VI. p. 367.
" " ! Lütk. 1857. Grönl. Ech., p. 24. Greenland.
" " ! Sars, 1857. Middelh. Litt. fauna, p. 115.
" " ! Sars, 1861. Norges Echin., p. 95.
" " ! Duj. Hupé, 1862. Échin. p. 532.
" " ! A. Agass. 1863. Proc. Boston S. N. H., p. 191.
" " ! A. Agass. 1863. Mem. Am. Ac., *f. 1–28.* (Pluteus and juv.)
" " ! A. Agass. 1863. Bull. M. C. Z., I. p. 23.
" " ! A. Agass. 1863. Proc. A. N. S. Phila., p. 357.
" " ! A. Agass. 1865. Seaside Studies, p. 101, *f. 131–138, 173–181.* (Pluteus).
" " ! Stewart, 1865. Trans. Lin. Soc. Lond., XXV. *Pl. L. f. 3.*
Echinometra " ! Gray, 1848. Brit. Rad., p. 4.
Euryechinus " ! Verrill, 1866. Proc. Boston S. N. H., p. 341, 352.
Echinus saxatilis Fab. 1780. Fauna Groenl., p. 368 (non Müll.).
" **neglectus** ! Lamk. 1816. An. s. Vert., p. 49. Atlantic. Europ.
" *neglectus* ! Agass. 1836. Prod., p. 190.
" " !? Forbes, 1841. Brit. Starf., p. 172, *f.*
" " ! Düb. o. Koren, 1844. Skand. Echin., p. 277.
Toxopneustes neglectus ! Agass. 1846. C. R. Ann. Sc. N., VI. p 367. Iceland.
" " ! Grube, 1851. Midd. Reise, II. p. 34.
" " ! Desor, 1855. Syn. Éch. foss., *Pl. XVIIbis. f. 1, 2.*
Echinus subangularis Flem. 1828. Brit. An., p. 479 (non Leske).
Strongylocentrotus chlorocentrotus Brandt, 1835. Prod., p. 264. Sitka.
Echinus chlorocentrotus Br. 1835. Prod.
" " Desml. 1837. Syn., p. 282.
Toxopneustes " ! Lütk. 1864. Bid., p. 144.
Echinus granularis ! Say, 1827. Journ. A. N. S. Phila., p. 225 (non Lamk.). Maine.
" *granulatus* ! Gould, 1841. Rep. Inv. Mass. Mass. Bay.
Toxopneustes " ! Agass. 1846. C. R. Ann. Sc. N., VI. p. 368.
" " ! Lütk. 1864. Bid., p. VI.
Euryechinus " ! Verrill, 1866. Proc. Boston S. N. H., pp. 340, 352.
Toxopneustes **Dubenii** ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 368. Arctic Seas.
" *Dubenii* ! Duj. Hupé, 1862. Échin., p. 532.

Strongylocentrotus Dröbachiensis (*continued*).

Echinus chloroticus ! Stimps. 1857. Crust. Echin. Pacif. Sh., p. 86.
Toxopneustes **carnosus** ! Barn. 1863, in Agass. Proc. A. N. S. Phila., p. 357. Avatcha Bay.
" **pictus** ! Norm. 1870. Dredg. Rep. Heb., p. 314. Shetland.
" **pallidus** ! Sars, 1870. Nye Echin. Vid. Selsk. Christiania.

*Norway (Sars); *Oresund (Eschricht); *Lofoten Islands, l. w., 60 fms. (G. O. Sars); *Great Britain (W. Stimpson); *Kattegat; *Greenland (Mus. Copenh.); *Labrador (Wyman); *Newfoundland (Dix); *Halifax (Hill); *Grand Menan (Mills); *Trenton Point, Me. (Verrill, Shaler, Hyatt); *Eastport (Stimpson); *Mass. Bay, *Nantucket, *S. Shoals (Agassiz); Cape Cod (A. Agassiz); *Charleston, S. C.? *Cape Florida? (Würdemann); *New Jersey coast (Gedney, Smithson. Coll.); *Hudson Bay (Drexler, Smithson. Coll.); *Gulf Georgia, W. T. (A. Agassiz); Sitka (Martens); *Avatcha Bay, *Behring Strait, Gulf of Penshinsk, Okhotch Sea (Stimpson, Smithson. Coll.); De Castries Bay! (Mus. Godeff.); Siberia (Middendorf); *Spitzbergen, Finmark! Iceland! Vancouver! (Mus. Stock.); Straits Belle Isle! Anticosti! Mingan Islands! (Packard); Gaspé (Dawson); Point Judith (Leidy); Long Island Sound (Verrill); Shetland, Orkney Islands (Forbes); Cape North (McAndrew & Barrett).

Strongylocentrotus eurythrogrammus

Echinus **eurythrogrammus** ! Val. 1846. Voyage Vénus, Zooph., *Pl. VII. f. 1.*
Heliocidaris eurythrogramma ! Des. 1846. C. R. Ann. Sc. N., VI. p. 371.
" " ! Duj. Hupé, 1862. Échin., p. 537.
Anthocidaris " ! Lütk. 1864. Bid., p. 165.
Toxocidaris " Verrill, 1871. Trans. Conn. Acad., I.
Echinus **tuberculatus** ! Lamk. 1816. A. s. Vert., p. 50. (Juv. pars.) So. Pacific.
" *tuberculatus* ! Blainv. 1825. Dict. Sc. N. O, p. 90.
" " ! Blainv. 1834. Actin., p. 228.
" " Desml. 1837. Syn., p. 284.
Toxopneustes *tuberculatus* ! Agass. 1841. An. Genre Ech. Val., p. IX. (pars.)
Toxopneustes " ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 367. (pars.)
" " ! Duj. Hupé, 1862. Échin., p. 532.
Echinus **Delalandi** ! Val. 1846. Agass. C. R. Ann. Sc. N., VI., p. 367. New Holland.
Toxopneustes Delalandi ! Agass. 1846. C. R. Ann. Sc. N., VI. p. 367.
" " Duj. Hupé, 1862. Échin., p. 532.
Toxocidaris " ! A. Agass. 1863. Bull. M. C. Z., I. p. 22.
Toxocidaris " ! A. Agass. 1863. Proc. A. N. S. Phila, p. 356
Euryechinus " Verrill, 1866. Proc. Bost. Soc. N. H.

*Port Jackson (Stimpson, Smithson. Coll.); *Hobson's Bay (Edwards); Chili! (J. d. P.) *Samoa Islands (Mus. Godeff.); Bass Straits! Van Diemen's Land! Bondy Head! Sidney! Torres Straits! (Brit. Mus.).

Strongylocentrotus franciscanus

Toxocidaris franciscana ! A. Agass. 1863. Bull. M. C. Z., I. p. 22. San Francisco.
Toxocidaris **globulosa** ! A. Agass. 1863. Proc. A. N. S. Phila., p. 356. Keelung. Hakodadi.

*Keelung, Formosa (Stimpson, Smithson. Coll.); ?Sidney! (Brit. Mus.); *San Francisco (Cary); *San Diego (Jewett); *Mendocino (A. Agassiz); Puget Sound! (Smithson. Coll.); Columbia River! (Brit. Mus.); Hakodadi! (Smithson. Inst.).

Strongylocentrotus Gaimardi

Echinus **Gaimardi** ! Blainv. 1825. Dict. S. N. O., p. 86. Rio.
" *Gaimardi* ! Blainv. 1834. Actin., p. 228.
" " Desml. 1837. Syn, p. 280.
" **aciculatus** ! Hupé, 1856. Castelnau Voyage, Am. Sud. Zooph., p. 97, *Pl. I. f 2.* Brazil.
Psammechinus aciculatus ! Duj. Hupé, 1862. Échin., p. 528.

*Desterro (Fitz Müller); Brazil! (J. d. P.); *Brazil (Hartt, Copeland, Thayer Exp.); Rio, Bahia (Mus. Copen.).

Strongylocentrotus gibbosus

Echinus **gibbosus** ! VAL. (MS. Mus. Paris).
Toxopneustes gibbosus ! AGASS. 1846. C. R. Ann. Sc. N., VI. p. 367. **Galapagos.**
Sphaerechinus " ! DUJ. HUPÉ, 1862. Échin., p. 530.
Euryechinus gibbus ! VERRILL, 1866. Proc. Bost. Soc. N. H., p. 341. **Peru.**
Euryechinus **imbecillis** ! VERRILL, 1867. Notes Radiata, p. 305. **Callao.**
Echinus **conicus** ! TROSCH. (MS. Mus. Frankfort.)

*Galapagos, *Chili (J. d. P.); *Callao, Paita (Bradley, Yale Coll.); *Feejee Islands?

Strongylocentrotus intermedius

Psammechinus **intermedius** ! BARN. 1863, in A. AGASS. Proc. Acad. N. S. Phila., p. 357. **Hakodadi.**
Boletia **radiata** ! MART. 1866. Wieg. Archiv, I. p. 136. **Naryasaki.**
Toxopneustes **grandiporus** LÜTK. (MS. Mus. Copenh.). **Seghalion.**

*Ousima (W. Stimpson, Smithson. Coll.); *Seghalion (H. A. Pierce); *New Holland.

Strongylocentrotus lividus

..... KLEIN, 1734. Nat. Disp. Ech., *Pl. XXX. f. C, D; Pl. XXXI. f. A, B.*
Echinus saxatilis LINN. 1758. Syst. Nat. p. 664, Ed. X. (non RUMPH. nec MULL.).
" " GMEL. 1788. LINN. Syst., 3171.
" " TIED. 1816. Anat. d. Röhren. Hol, *Pl. X.*
" **lividus** ! LAMK. 1816. An. S. Vert., p. 50. **Mediterranean.**
" *lividus* ! BLAINV. 1825. Dict. Sc. N., p. 88.
" " ! BLAINV. 1834. Actin., p. 228.
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn., p. 282.
" " EDW. in CUV. Règ. An. Ed. Ill., *Pl. XI. f. 2–4.*
" " !? FORBES, 1841. Brit. Starf., p. 167, *f.*
Strongylocentrotus lividus BRANDT, 1835 Prod.
Echinus " ! VAL. 1841. Anat. Genre Echin., *Pl. I. f. 1–3*, et passim, *Pl. II–IX.*
Toxopneustes " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 367.
" " KROHN, 1849. Echinod. Larv., *Pl.* (Pluteus.)
" " SARS, 1857. Middelh. Litt. fauna. p. 162.
" " ! DUJ. HUPÉ, 1862. Échin., p. 532.
" " MÜLL. 1853. Abhandl. IV., *Pl. VI. f. 7–14; Pl. VII. f. 1–8.* (Pluteus.)
" " BRONN, 1859. Kl. u. O. Actin, p. 333, *Pl XXXVII. f. 4–15; Pl. XXXVIII.; Pl. XL. f. 1–19.*
" " METCHNI. 1870. Nem. u. Echinod., *Pl. VII. f. 1–7: Pl. VIII. f. 8, 9.* (Pluteus.)
Euryechinus " ! VERRILL, 1866. Proc. Boston S. N. H., p. 341.
Echinus **vulgaris** ! BLAINV. 1825. Dict. Sc. Nat. O., p. 86.
" *vulgaris* ! BLAINV. 1834. Actin., p. 228.
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn., p. 278.
" *purpureus* RISSO, 1826. Europ. Mérid., V. p. 277 (non GMEL.).
" " GRAY, 1848. Brit. Rad., p. 4.
Toxopneustes **concavus** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 367.
" *concavus* ! DUJ. HUPÉ, 1862. Échin., p. 532.
Echinus **complanatus** ! VAL. (MS. Mus. Paris).
Toxopneustes complanatus ! AGASS. 1846. C. R. Ann. S. Nat., VI. p 367.
" " ! DUJ. HUPÉ, 1862. Échin., p. 532.
" **mammillatus** ! MICH. (MS. Mus. Écol. Min. Paris).

*Finistère, *Loire (Caillaud); *Nice (Verany, Burkhardt); *Cette (Lyman); *Spezzia; *W. coast Italy (Rigacci); *Fayal (Dabney, Higginson); *Lanzerote (Haeckel); **Triest, Messina** (Sars); Marseilles (Müller); So. England (Forbes).

Strongylocentrotus mexicanus

Toxocidaris *mexicana* ! (**A. Agass.**) 1863. Bull. M. C. Z., I. p. 22 (non Hel. mex. Ag.). Acapulco.
Toxocidaris mexicana ! Verrill, 1871. Notes Radiata, p. 584.
Toxopneustes sp. ! Verrill, 1867. Notes Radiata, p. 307.

*Cape St. Lucas, Gulf of California ! (Xanthus, Smithson. Coll.).

Strongylocentrotus nudus

Toxocidaris **nuda** ! A. Agass. 1863. Proc. A. N. S. Phila., p. 356. Hilo. Niphon.

*Sandwich Islands, N. End Niphon (W. Stimpson).

Strongylocentrotus purpuratus

Echinus **purpuratus** ! Stimps. 1857. Crust. Echin. Pac. Coast, p. 86. San Francisco.
Loxechinus purpuratus ! A. Agass. 1863. Bull. M. C. Z., I. p. 23. Mendocino.
" " ! A. Agass. 1863. Proc. Acad. N. S. Phila., p. 357.
Echinometra **No. 274** ! Perrier, 1869. Pédic.

*California ; *Crescent City, *Mendocino, *San Francisco (A. Agassiz) ; Puget Sound ! (Smithson. Coll.).

Strongylocentrotus tuberculatus

Echinus **tuberculatus** ! Lamk. 1816. A. s. Vert., p. 50. (pars.) So. Pacific.
Strongylocentrotus *tuberculatus* Br. 1835 Prod.
Toxopneustes tuberculatus Agass. 1846. C. R. Ann Sc Nat., VI. p. 367. (pars.)
Echinus **omalostoma** ! Val. 1846. Voyage Vénus, Zooph., *Pl. VI. f. 2.* New Zealand.
Heliocidaris omalostoma ! Des. 1846. Agass. C. R. Ann. Sc. N., VI. p. 372. China.
Heliocidaris " ! Duj. Hupé, 1862. Échin., p. 537.
Anthocidaris *homalostoma* ! Lütk. 1864. Bid., p. 165.
Toxocidaris homalostoma Verrill, 1871. Proc. Conn. Acad., I.
Toxocidaris **crassispina** ! A. Agass. 1863. Proc. A. N. S. Phila., p. 356. Hong Kong.
" **purpurea** ! Mart. 1866. Wieg. Arch., p. 137. Nagasaki.

*Hakodadi (W. Stimpson, Dall, Smithson. Coll.) ; *Kanagawa (Heco) ; *Yokohama (Salmin) ; *Hong Kong (Behm, Kiel Mus.) ; Japan (École. Min.) ; Nagasaki ! (Martens, Mus. Berl.) ; New Holland ! (Mus. Copenh.) ; New Zealand ! China ! Galapagos ! (J. d. P.).

TEMNECHINUS.

Temnechinus Forbes, 1852. Monog. Echinod, Brit. Tertiaries.
Genocidaris A. Agass. 1869. Bull. M. C. Z., I.

Temnechinus maculatus

Genocidaris maculata ! A. Agass. 1869. Bull. M. C. Z., I. 262. Straits of Florida.

*Off Tortugas, 30, 34, 35, 37, 60, 68 fms., *off Alligator Reef, 79, 88, 138, 147, fms., *S. W. Sand Key, 10, 119, 125, 138 fms, *off Conch Reef, 9, 30, 39, 49, 77, 169 fms., *Florida Gulf Stream, 16, 75 fms., *off Carysfort Reef, 40, 48, 60, 63 fms., *off Tennessee Reef, 115 fms., *off Elbow Reef, 75 fms., *off French Reef, 147 fms., *Key West, off Sand Beach, 5 fms., (Pourtalès) ; Josephine Bank ! 600 fms. (Mus. Stock.).

TEMNOPLEURUS.

Cidaris KLEIN, 1734. Nat. Disp. Echin. (pars.)
Echinus LAMK. 1816. An. s. Vert. (pars.)
Temnopleurus AGASS. 1841. Mon. Scut. Introd.
Temnopleurus AGASS. 1841. VAL. Anat. Genre Echin.
Toreumatica GRAY, 1855. Proc. Zoöl. Soc. London. (pars.)
Toreumatica A. AGASS. 1863. Proc. A. N. S. Phila. (pars.)
Microcyphus A. AGASS. 1863. Proc. A. N. S. Phila.
Temnotrema A. AGASS. 1863. Proc. A. N. S. Phila.

Temnopleurus Hardwickii

Toreumatica Hardwickii ! GRAY, 1855. Proc. Zoöl. Soc. London, p. 39.
Microcyphus **elegans** ! A. AGASS. 1863. Proc. Phil. Acad. N. S. p. 357. Yedo.
Temnopleurus **japonicus** ! MART. 1866. Wieg. Arch., p. 133. Hakodadi. Jesso.
Temnotrema sculpta A. AGASS. 1863. Proc. Ac. N. S. Phila., p. 358. Japan.

*E. coast Niphon (Stimpson, Smithson. Coll.); *Japan (Salmin); Hakodadi! (Stimpson, Smithson. Coll.); *Yokohama (Berl. Mus.); Nagasaki! Yedo! (Berlin Mus.); Unalaska! (Dall, Smithson. Coll.); *Kagosima (Stimpson, Smithson. Coll.).

Temnopleurus Reynaudi

Temnopleurus **Reynaudi** ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 360. Ceylon.
" *Reynaudi* ! DUJ. HUPÉ, 1862. Échin., p. 514. China.
Toreumatica Reevesii ! GRAY, 1855. Proc. Zoöl. Soc. London, p. 39 (non Temn. Reev. A. AG.).
Toreumatica granulosa ! GRAY, 1855. Proc. Zoöl Soc. London, p. 39.
Toreumatica concava ! A. AGASS. 1863. Proc. A. N. S. Phila, p. 358 (non GRAY). Hong Kong.

*Ceylon (Humbert, Loriol); *Hong Kong (Putnam); Isle Negros! China! (Brit. Mus.); Malacca! (J. d. P.); Burmah! (Acad. N. S. Phila.); No. China Seas! (Stimpson, Smithson. Coll.).

Temnopleurus toreumaticus

Cidaris toreumatica ! KLEIN, 1734. Nat. Disp. Ech., p. 64, *Pl. X. f. E.*
Cidaris toreumatica LESKE, 1778. KL. Add., p. 155, *Pl. X. f. E.*
Echinus toreumaticus GMEL. 1788. LINN. Syst. N., 3180.
" " ! BLAINV. 1825. Dict. Sc. Nat. O., p. 82.
" " ! BLAINV. 1834. Actin., p. 227.
" " DESML. 1837. Syn., p. 274.
" " ! VAL. 1846. Voyage Vénus, Zooph., *Pl. I. f. 1.*
Temnopleurus *toreumaticus* ! AGASS. 1841. Mon. Scut.
Temnopleurus " ! AGASS. 1841. VAL. Anat. Genre Echin., p. VII.
" " ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 360, *Pl. XV. f. 9.* Bombay.
" " DESOR, 1856. Synops. Échin. foss., p. 108, *Pl. XVII. f. 8–10.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 514.
" " ! A. AGASS. 1863. Bull. M. C. Z., I. p. 23.
Echinus **sculptus** ! LAMK. 1816. An. s. Vert., p. 47. Indian Ocean?
" *sculptus* DESLONG. 1824. Enc. Méth., II. p. 590, *Pl. CXLII. f. 4, 5.*
Temnopleurus bothryoides ! AGASS. 1846. C. R. Ann. Sc. Nat., VI. p. 360. (pars.)
" *Reevesii* ! A. AGASS. 1863. Bull. M. C. Z., I. p. 23 (non Tor. R. GRAY). Hong Kong.
" " ! A. AGASS. 1863. Proc. An. S. Phila., p. 358.

*Bombay; *E. India (Phila. Acad.); *Philippine Islands (Cotteau); *Hong Kong (Putnam); *Siam (Salmin); No. China Sea! (Stimpson, Smithson. Coll.); Karrak Island, Gulf of Persia! (J. d. P.); China! (Mus. Copenh.).

TOXOPNEUSTES.

Echinus LAMK. 1816. A. s. Vert. (pars.)
Toxopneustes AGASS. 1841. Int. Monog. Scut. (non AGASS. 1841, Anat. Echin.).
Psammechinus AGASS. 1846. C. R. Ann. Sc. Nat., VI. (pars.)
Boletia DES. 1846. C. R. Ann. Sc. Nat., VI. p. 362.
Anapesus HOLMES, 1860. Post Plioc. foss. So. Ca.
Boletia AGASS. 1861. Cont. Nat. H. U. S., I. p. 97.
Lytechinus A. AGASS. 1863. Bull. M. C. Z., I.
Psilechinus LÜTK. 1864. Bid.
Lytechinus VERRILL, 1867. Notes Radiata.
Boletia VERRILL, 1871. (pars.)
Hemiechinus GIRARD, MS.

Toxopneustes maculatus

..... GUALTERI, 1742. *Pl. CVII. f. M.*
..... SEBA, 1758. Thes., III. *Pl. XI. f. 6, 8.*
Echinus **maculatus** ! LAMK. 1816. An. s. Vert., p. 46. Indian Ocean ?
" *maculatus* ! BLAINV. 1825. Dict. S. N. O., p. 87.
" " ! BLAINV. 1834. Actinol., p. 228.
" " DESML. 1837. Syn., p. 280.
Boletia *maculata* ! DES. 1846. C. R. Ann. Sc. Nat., VI. p. 363.
Boletia " ! DUJ. HUPÉ, 1862. Échin., p. 534, *Pl. IX f. 9.*
Echinus **depressus** ! BLAINV. 1825. Dict. S. N. O., p. 84.
" *depressus* ! BLAINV. 1834. Actinol., p. 228.
" " DESML. 1837. Syn., p. 276.
" " ! VAL. 1846. Voyage Vénus, Zooph., *Pl. III. f. 1.*
Hemiechinus *depressus* ! GIR. MS.

*Christmas Island (J. D. Hague) ; Bourbon ! (Écol. Min.).

Toxopneustes pileolus

Echinus **pileolus** ! LAMK. 1816. An. s. Vert., p. 45. Isle de France.
" *pileolus* ! BLAINV. 1825. Dict. S. N. O., p. 90.
" " ! BLAINV. 1834. Actinol., p. 228.
" " ! AGASS. 1836. Prod., p. 23.
" " DESML. 1837. Syn., p. 284
" " ! MICH. 1845. Rev. Mag. Zoöl., p. 9.
" " ! VAL. 1846. Voyage Vénus, Zooph., *Pls. VIII., IX.*
Boletia " ! DES. 1846. C. R. Ann. Sc. Nat., VI. p. 362.
Boletia " MÜLL. 1854. Bau d. Echin., *Pl. II. f. 3.*
" " BRONN, 1859. Klassen u. Ord. Actin., *Pl. XXXIX. f. 7.*
" " ! DUJ. HUPÉ, 1862. Échin., p. 534, *Pl. IX. f. 4.*
" " ! PERRIER, 1869. Pédic., p. 157.
Toxopneustes *pileolus* AGASS. 1841. Int. Mon. Scut.
Echinus **polizonalis** ! LAMK. 1816. An. s. Vert., p. 45.
" *polizonalis* ! BLAINV. 1825. Dict. S. N. O., p. 84.
" " ! BLAINV. 1834. Actinol., p. 228.
" " DESML. 1837. Syn., p. 276.
Boletia " ! MART. 1866. Wieg. Arch., I. p. 162. Molucca. Timor.
Echinus **obtusangulus** ! LAMK. 1816. An. s. Vert., p. 46. Indian Ocean.
Boletia heteropora ! DES. 1846. C. R. Ann. Sc. Nat., VI. p. 362. Indian Ocean.
Boletia heteropora ! DUJ. HUPÉ, 1862. Échin., p. 534.

Toxopneustes pileolus (*continued*).

Echinus **trizonalis** ! Blainv. 1825. Dict. S. N. Oursin, p. 84.
" *trizonalis* ! Blainv. 1834. Actinol., p. 228.
" " Desml. 1837. Syn., p. 276.
Boletia bizonata ! Des. 1846. C. R. Ann. Sc Nat., VI. p. 363.
Boletia bizonata ! Duj. Hupé, 1862. Échin., p. 535.
" **rosea** ! A. Agass. 1863. Bull. M. C. Z., I. p. 24. Acapulco.
" *rosea* ! Verrill, 1871. Notes Radiata, p. 583.
" *picta* ! Verrill, 1871. Trans. Con. Acad., I. p. 581. Gulf of California. La Paz.
Lytechinus roseus ! Verrill, 1867. Notes Radiata, p. 302. Panama Bay.

*Mauritius (Pike); Muscat! (Cook, Essex Inst.); East India! Seychelles! (J. d. P.); New Caledonia! (Crosse); Philippine Islands! (Semper); Keeling! (Stockholm); *Feejee Islands (Mus. Godeff.); Gulf of Persia! Bourbon! (Écol. Min.); Timor, Molucca (Martens); Siguigor! (Brit. Mus.); Japan! (Smithson. Coll.); *Acapulco (A. Agassiz); *Pearl Islands (Bradley, Yale Coll.); Mazatlan! (Vienna, Stockholm, Copenh. Mus.); Panama! La Paz! (Yale Coll.).

Toxopneustes semituberculatus

Echinus **semituberculatus** ! Val. 1846 in Agass. C. R. Ann. Sc. Nat., VI. p. 368.
Psammechinus *semituberculatus* ! Agass. 1846, C. R. Ann. Sc. Nat., VI. p. 368. Galapagos.
Psammechinus semituberculatus ! Duj. Hupé, 1862. Échin, p. 527.
Lytechinus " ! A. Agass. 1869. Bull. M. C. Z., I. p. 301.
Schizechinus " Pomel, 1869. Revue d. Echin., p. XLII.
Psammechinus **pictus** ! Verrill, 1867. Notes Radiata, p. 301. Cape St. Lucas.
Boletia picta ! Verrill, 1871. Notes Radiata, p. 581. (pars.) La Paz.

*Galapagos Islands; W. coast Cent. Am.! (Stockholm, Bonn Mus.); *Cape St. Lucas (Xanthus, Smithson. Coll.).

Toxopneustes variegatus

..... Gualteri, 1742. Index Tert., *Pl CVII. f. F.*
Echinus variegatus ! (Lam.) 1816. An. s. Vert., p. 48 (non Cid. varieg. Leske). St. Domingo.
" *variegatus* ! Blainv. 1825. Dict. Sc. Nat. O., p. 83.
" " Say, 1827. Jour. Ac. N. S. Phila, p. 225.
" " Blainv. 1834. Actin., p. 227.
" " ! Agass. 1836. Prod., p. 23.
" " Desml. 1837. Syn., p. 276.
" " ! Rav. 1848. Cat. Ech. So. Ca.
Psammechinus *variegatus* ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 368. Yucatan.
Psammechinus " ! Duj. Hupé. 1862. Échin, p. 527.
" " ! Perrier, 1869. Pédic, p. 149.
Lytechinus " ! A. Agass. 1863. Bull. M. C. Z., I. p. 24. Cienfuegos. Hayti.
Lytechinus " ! Verrill, 1867. Notes Rad., p. 369. Cape Frio. Porto Seguro.
" " ! A. Agass. 1869. Bull. M. C. Z., I. p. 264. No. Carolina.
Psilechinus " ! Lütk. 1864. Bid., p. 93.
Echinus **excavatus** ! Blainv. 1825. Dict. Sc. Nat. O., p. 83.
" *excavatus* ! Blainv. 1834. Actin., p. 227.
Psammechinus *excavatus* ! Agass. 1846. C. R. Ann. Sc. Nat., VI. p. 369. Martinique. Brazil.
Psammechinus " ! Duj. Hupé, 1862. Échin., p. 527.
Echinus **Blainvillei** Desml. 1837. Syn., p. 276.
? *Psammechinus* **exoletus** McCrady, 1857. Plioc. Foss. So. Ca., *Pl. II. f. 6.*
Anapesus carolinus ! Holmes, 1860. Post Plioc. Foss. So. Ca., *Pl. II. f. 2.* So. Carolina.
Lytechinus *carolinus* ! A. Agass. 1863. Bull. M. C. Z., I. p. 24. Georgia. Florida.
" **atlanticus** ! A. Agass. 1863. Bull. M. C. Z., I. p. 24. Bermudas.
Hemiechinus nobilis Gir. MS. Mus. Smiths. (teste Verrill).

Toxopneustes variegatus (*continued*).

Schizechinus *variegatus* POMEL, 1869. Rev. d. Echin., p. XLII.
" *excavatus* POMEL, 1869. Rev. d. Echin., p. XLII.
Echinus flammeus MS. (É. M.)

*W. Indies (Ames); *Jamaica (Adams); *Hayti (Weinland, Uhler); *St. Thomas (Thayer Ex.); *Cienfuegos, Cuba (Aviles); *Captiva Key, Fla. (Würdeman); *Port au Prince (Ackerman); *Rio Janeiro (Agassiz, Thayer Exp.); *Armaçao, *Bahia, *Porto Seguro (Hartt & Copeland, Thayer Exp.); *Cape Fear Riv. Bar, 7 fms, *Florida Gulf Stream, 34 fms., *off Sand Key, 24 fms., *Tortugas, 5–7 fms., *Florida Reef (Pourtalès); *Cape Florida (Würdeman); *Gulf of Mexico; *Charleston, S. C. (Agassiz, Gibbes); *Tampa Bay (Conrad); *Isle of Britain, Mouth of Miss. (Peirce); *Beaufort, N. C. (Bickmore); *Bermudas (Hammond, Bickmore); Martinique! Guadeloupe! (J. d. P.); Yucatan! (Écol. Min.); Cuba! (Arango); Cape Frio, Vittoria (Hartt).

TRIGONOCIDARIS.

Trigonocidaris A. AGASS. 1869. Bull. M. C. Z., I.

Trigonocidaris albida

Trigonocidaris albida! A. AGASS. 1869. Bull. M. C. Z., I. p. 263. Straits Florida.

*Florida Gulf Stream, 98, 123, 125, 130, 138 fms., *off Conch Reef, 40 fms., *off Sand Key, 119, 120, 129, 138, 154 fms., *off Samboes, 125 fms., *off Key West, 135 fms., *off Havana, 270 fms., *off Sombrero, 125 fms. (Pourtalès).

(HEMIASTER.) TRIPYLUS.

Tripylus PHIL. 1845. Wieg. Arch., I.
Agassizia AGASS. 1847. C. R. Ann. Sc. Nat., VIII. (pars)
Brissopsis AGASS. 1847. C. R. Ann. Sc. Nat., VIII. (pars.)
Faorina GRAY, 1851. Ann. Mag. N. H., VII. (pars)
Hamaxitus TROSCH. 1851. Wieg. Arch.

Tripylus excavatus

Tripylus excavatus! PHIL. 1845. Wieg. Arch., I. p. 344, *Pl. XI. f. 1.* So. Extrem. So. Am.
Tripylus (**Hamaxitus**) *excavatus*! TROSCH. 1851. Wieg. Arch., p. 72.
" *excavatus*! GRAY, 1855. Cat. Rec. Echin, p. 59. So. Extrem So. Am.
Agassizia excavata! AGASS. 1847. C. R. Ann. Sc. Nat., VIII. p. 20.
Brissopsis " ! DUJ. HUPÉ, 1862. Échin., p. 597.

*M. C. Z.; Straits of Magellan! (Brit. Mus., Cunningham); So. Extrem. So. Am.! (Brit. Mus.); Chili! (Philippi).

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Dufresnii Bl. **Arbacia** *Dufresnii* Gray, 91.
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laganoides Des. *Echinostrephus molare* A. Agass., 119.
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lathyrus Gmel. **Fibularia** *ovulum* Lamk., 129.
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mammillatus Linn. **Heterocentrotus** *mammillatus* Br., 133.
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pustulatus Agass. *Echinus* **miliaris** Müll., 125.
pustulosus Gmel. **Arbacia** *pustulosa* Gray, 92.
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raninus Gmel. **Fibularia** *ovulum* Lamk., 130.
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subangularis FLEM. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.
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mammillatus Br. **Heterocentrotus** *mammillatus* Br., 133.
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taeniatus Br. **Heterocentrotus** *trigonarius* Br. 134.
trigonarius Br. **Heterocentrotus** *trigonarius* Br. 134.
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mammillatus Müll. **Heterocentrotus** *mammillatus* Br. 133.
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Scaphechinus BARN. 1863.
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Schizaster AGASS. 1836.
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canaliferus AGASS. *Schizaster canaliferus* AGASS., 157.
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cubensis D'ORBIG. *Meoma ventricosa* LÜTK., 143.
cubensis **A.** AGASS. *Schizaster fragilis* AGASS., 157.
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gibberulus AGASS. *Schizaster* **gibberulus** AGASS., 158.
incertus ARADAS. *Brissopsis lyrifera* AGASS., 96.
Jukesii GRAY. *Schizaster* **ventricosus** GRAY, 158.
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Philippii **A.** AGASS. *Schizaster Philippii* **A.** AGASS., 158.
ventricosus GRAY. *Schizaster* **ventricosus** GRAY, 158.
Schizechinus POMEL, 1869.
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variegatus POMEL. *Toxopneustes variegatus* **A.** AGASS., 169.
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ambigena LAM. *Clypeaster humilis* **A.** AGASS., 100.
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bifora LAM. *Echinodiscus biforis* **A.** AGASS., 113.
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caroliniana RAV. *Mellita sexforis* **A.** AGASS., 141.
cassidulina DESML. *Encope emarginata* AGASS., 126.
clypeastriformis BL. *Clypeaster scutiformis* LAMK., 101.
decadactylos BL. **Rotula Augusti** KL., 154.
decagonalis LESS. *Peronella decagonalis* **A.** AGASS., 148.
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emarginata LAM. *Encope emarginata* AGASS., 126.
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gibbosa (**Rav.**) *Clypeaster subdepressus* AGASS., 101.
hexapora BL. *Mellita sexforis* **A.** AGASS., 141.
inaurita BL. *Echinodiscus* **auritus** LESKE, 113.
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japonica MART. *Echinarachnius mirabilis* **A.** AGASS., 107.
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latissima LAM. *Clypeaster humilis* **A.** AGASS., 98.

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octodactylos BL. **Rotula Augusti** KL., 154.
orbicularis (**Lam.**). **Peronella** *Peronii* GRAY, 149.
ovalis AGASS. *Clypeaster scutiformis* LAMK., 101.
parma LAM. *Echinarachnius parma* GRAY, 107.
pentapora BL. **Mellita testudinata** KL., 142.
pentaphora SAY. **Mellita testudinata** KL., 142.
placenta LAM. *Arachnoides placenta* AGASS., 90.
placunaria LAM. *Clypeaster humilis* A. AGASS., 100.
porpita DESLONG. *Arachnoides placenta* AGASS., 90.
quadrifora LAM. *Encope emarginata* AGASS., 126.
quinquefora LAM. **Mellita testudinata** KL., 142.
quinqueloba ESCH. *Encope emarginata* AGASS., 126.
radiata BL. **Rotula Rumphii** KL., 155.
reticulata BL. *Clypeaster scutiformis* LAMK., 101.
Rumphii BL. *Echinarachnius parma* GRAY, 108.
semisol BL. **Rotula Rumphii** KL., 155.
sexforis LAM. *Mellita sexforis* A. AGASS., 141.
striatula CONRAD. *Echinarachnius excentricus* VAL., 107.
tetrapora BL. *Encope emarginata* AGASS, 126.
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Scutellina AGASS. 1841.

Scutum KLEIN, 1734.
ovatum KLEIN. **Echinolampas** *oviformis* GRAY, 114.

Sismondia DES. 1857.

Spatagoides KLEIN, 1734.

Spatagus MÜLL. 1774.
flavescens MÜLL. *Echinocardium flavescens* A. AGASS., 110.
purpureus MÜLL. *Spatangus purpureus* LESKE, 158.
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Spatangites LESKE, 1778.

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altus LÜTK. MS. *Spatangus* **Lütkeni** A. AGASS., 158.
arcuarius LAM. *Echinocardium cordatum* GRAY, 109.
atropos LAM. **Moira** *atropos* A. AGASS, 146.
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australis PHIL. *Hemiaster australis* A. AGASS., 132.
brissus LESKE. ?
canaliferus LAM. *Schizaster canaliferus* AGASS., 157.
carinatus LAM. *Brissus carinatus* GRAY, 96.
carinatus RISSO. **Brissus unicolor** KL., 97.
cavernosus PHIL. *Hemiaster cavernosus* A. AGASS, 132.
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compressus LAM. *Metalia maculosa* A. AGASS., 144.
cordatus FLEM. *Echinocardium cordatum* GRAY, 109.
Crux Andreae LAM. *Breynia Australasiae* GRAY, 95.
elongatus GRAY. *Lovenia elongata* GRAY, 139.
excavatus PHIL. **Tripylus excavatus** PHIL. 169.
flavescens ABILD. *Echinocardium cordatum* GRAY, 109.
grandis BL. *Metalia pectoralis* A. AGASS., 144.
Gualterii BL. *Schizaster canaliferus* AGASS., 157.
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ovatus FLEM. *Echinocardium flavescens* A. AGASS., 110.
ovatus LESKE. **Brissus unicolor** KL., 97.
ovatus LMK. **Brissus unicolor** KL., 97.
ovatus LESKE. **Maretia** *planulata* GRAY, 140.
pectoralis LAMK. *Metalia pectoralis* A. AGASS., 144.
placenta PHIL. **Brissus unicolor** KL., 97.
planulatus LAMK. **Maretia** *planulata* GRAY, 140.
pulvinatus PHIL. *Brissopsis lyrifera* AGASS., 96.
purpureus LESKE. *Spatangus purpureus* LESKE, 158.
pusillus MÜLL. *Echinocardium cordatum* GRAY, 109.
pusillus LESKE. *Echinocardium cordatum* GRAY, 109.
Raschi LOVÉN. *Spatangus* **Raschi** LOVÉN, 159.
Reaumuri DESML. *Echinocardium cordatum* GRAY, 109.
Reginae GRAY. *Spatangus purpureus* LESKE, 159.
Rumphii DESML. *Metalia maculosa* A. AGASS., 144.
spinosissimus DES. *Spatangus purpureus* LESKE, 159.
sternalis LAM. **Metalia** *sternalis* GRAY, 145.
subcarinatus GRAY. *Lovenia subcarinata* GRAY, 139.
unicolor LESKE. **Brissus unicolor** KL., 97.
unicolor BL. **Brissus unicolor** KL., 97.
variegatus GRAY. **Maretia** *planulata* GRAY, 140.
ventricosus LAM. *Meoma ventricosa* LÜTK., 143.
Sphaerechinus DES. 1856.
Australiae A. AGASS. *Sphaerechinus* **Australiae** A. AGASS, 159.
brevispinosus DES. *Sphaerechinus granularis* A. AGASS, 160.
esculentus DUJ. HUPÉ. *Echinus esculentus* LINN., 123.
esculentus BRONN. *Sphaerechinus granularis* A. AGASS., 159.
gibbosus DUJ. HUPÉ. *Strongylocentrotus gibbosus* A. AGASS., 164.
granularis A. AGASS. *Sphaerechinus granularis* A. AGASS., 159.
pulcherrimus A. AGASS. *Sphaerechinus pulcherrimus* A. AGASS., 160.
Sphaeriechinus LÜTK. 1864 (err. typ.).
indianus LÜTK. *Pseudoboletia indiana* A. AGASS., 153.
Stenonia DES. 1857.
Stephanocidaris A. AGASS. 1863.
bispinosa A. AGASS. *Stephanocidaris bispinosa* A. AGASS., 160.
tubaria A. AGASS. *Stephanocidaris bispinosa* A. AGASS., 160.
Stigmatopygus D'ORBIG. 1855.
Stirechinus DES. 1856.
Stoloniclypeus VERRILL, 1867 (err. typ.).
rotundus VERRILL. *Clypeaster rotundus* A. AGASS., 100.
Stolonoclypus AGASS. 1863.
placunarius AGASS.
prostratus A. AGASS. *Clypeaster subdepressus* AGASS., 101.
Ravenellii A. AGASS. *Clypeaster subdepressus* AGASS., 101.
rotundus A. AGASS. *Clypeaster rotundus* A. AGASS., 100.
Stomechinus DES. 1855.
Stomopneustes AGASS. 1841.
variolaris AGASS. **Stomopneustes** *variolaris* AGASS., 161.
Strongylocentrotus BR. 1835.
albus A. AGASS. *Strongylocentrotus albus* A. AGASS., 162.
armiger A. AGASS. *Strongylocentrotus* **armiger** A. AGASS., 162.
chlorocentrotus BR. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.

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depressus A. Agass. *Strongylocentrotus depressus* A. Agass., 162.
Dröbachiensis A. Agass. *Strongylocentrotus Dröbachiensis* A. Agass., 162.
eurythrogrammus A. Agass. *Strongylocentrotus eurythrogrammus* A. Agass., 163.
franciscanus A. Agass. *Strongylocentrotus franciscanus* A. Agass., 163.
Gaimardi A. Agass. *Strongylocentrotus Gaimardi* A. Agass., 163.
gibbosus A. Agass. *Strongylocentrotus gibbosus* A. Agass., 164.
intermedius A. Agass. *Strongylocentrotus intermedius* A. Agass., 164.
lividus Br. **Strongylocentrotus** *lividus* Br., 164.
longispina Br. *Echinostrephus molare* A. Agass., 119.
mexicanus A. Agass. *Strongylocentrotus mexicanus* A. Agass., 165.
mola Br. *Echinostrephus molare* A. Agass., 119.
nudus A. Agass. *Strongylocentrotus nudus* A. Agass., 165.
parvituberculatus Br. *Echinus* **microtuberculatus** Bl., 124.
purpuratus A. Agass. *Strongylocentrotus purpuratus* A. Agass., 165.
subglobiformis Br. *Sphaerechinus granularis* A. Agass., 160.
tuberculatus Br. **Strongylocentrotus** *tuberculatus* Br., 165.

Temnechinus Forbes, 1852.
maculatus A. Agass. *Temnechinus maculatus* A. Agass., 165.
Temnocidaris (**A. Agass.**). 1863 (non Cott.).
canaliculata A. Agass. *Goniocidaris canaliculata* A. Agass., 13.
Temnocidaris Cott. 1863.
Temnopleurus Agass. 1841.
bothryoides Agass. **Pleurechinus** *bothryoides* Agass., 152.
depressus D'A. & H. **Temnopleurus** *toreumaticus* Agass., 166.
elegans Mich. MS. *Salmacis* **Dussumieri** Agass., 156.
Hardwickii A. Agass. *Temnopleurus Hardwickii* A. Agass., 166.
japonicus Mart. *Temnopleurus Hardwickii* A. Agass., 166.
Reevesii A. Agass. **Temnopleurus** *toreumaticus* Agass., 166.
Reynaudi Agass. *Temnopleurus* **Reynaudi** Agass., 166.
toreumaticus Agass. **Temnopleurus** *toreumaticus* Agass., 166.
Temnotrema A. Agass. 1863.
sculpta A. Agass. *Temnopleurus Hardwickii* A. Agass. 166.
Tetragramma Agass. 1840.
Tetrapygus Agass. 1841.
aequituberculatus Agass. **Arbacia** *pustulosa* Gray, 92.
grandinosus Agass. **Arbacia** *pustulosa* Gray. 92.
niger Agass. *Arbacia nigra* A. Agass., 91.
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Thrichodiadema A. Agass. 1863.
coronatum A. Agass. *Centrostephanus coronatus* A. Agass., 97.
Rodgersii A. Agass. *Centrostephanus Rodgersii* A. Agass., 98.
Thrichoproctus Agass. MS.
tenuis Agass. MS. **Maretia** *planulata* Gray, 140.
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Toxobrissus Des. 1858.
Toxocidaris A. Agass. 1863.
crassispina A. Agass. **Strongylocentrotus** *tuberculatus* Br., 165.

Toxocidaris A. AGASS. 1863 (*continued*).
Delalandi A. AGASS. *Strongylocentrotus eurythrogrammus* A. AGASS., 163.
depressa A. AGASS. *Strongylocentrotus depressus* A. AGASS., 162.
eurythrogramma VERRILL. *Strongylocentrotus eurythrogrammus* A. AGASS., 163.
franciscana A. AGASS. *Strongylocentrotus franciscanus* A. AGASS., 163.
globulosa A. AGASS. *Strongylocentrotus franciscanus* A. AGASS., 163.
homalostoma VERRILL. **Strongylocentrotus** *tuberculatus* BR., 165.
mexicana (**A. Agass.**) *Strongylocentrotus mexicanus* A. AGASS., 165.
nuda A. AGASS. *Strongylocentrotus nudus* A. AGASS., 165.
purpurea MART. **Strongylocentrotus** *tuberculatus* BR., 165.

Toxopneustes AGASS. 1841.
aequituberculatus DUJ. HUPÉ. **Sphaerechinus** *granularis* DES, 160.
albidus AGASS. *Sphaerechinus granularis* A. AGASS., 160.
brevispinosus AGASS. *Sphaerechinus granularis* A. AGASS., 160.
carnosus BARN. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.
chlorocentrotus LÜTK. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.
complanatus AGASS. **Strongylocentrotus** *lividus* BR., 164.
conoavus AGASS. **Strongylocentrotus** *lividus* BR., 164.
Delalandi AGASS. *Strongylocentrotus eurythrogrammus* A. AGASS., 163.
Dröbachiensis AGASS. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.
Dubeni AGASS. *Strongylocentrotus Dröbachiensis* A. AGASS., 163.
gibbosus AGASS. *Strongylocentrotus gibbosus* A. AGASS., 164.
grandiporus LÜTK. *Strongylocentrotus intermedius* AGASS., 164.
granulatus AGASS. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.
granularis AGASS. *Sphaerechinus granularis* A. AGASS., 159.
indianus MICH. *Pseudoboletia indiana* A. AGASS., 153.
lividus AGASS. **Strongylocentrotus** *lividus* BR., 164.
maculatus A. AGASS. *Toxopneustes maculatus* A. AGASS., 167.
mammillatus MICH. MS. **Strongylocentrotus** *lividus* BR., 164.
neglectus AGASS. *Strongylocentrotus Dröbachiensis* A. AGASS., 162.
pallidus G. O. SARS. *Strongylocentrotus Dröbachiensis* A. AGASS., 163.
pictus NORMAN. *Strongylocentrotus Dröbachiensis* A. AGASS., 163.
pileolus AGASS. **Toxopneustes** *pileolus* AGASS., 167.
sp. VERRILL. *Strongylocentrotus mexicanus* A. AGASS., 165.
semituberculatus A. AGASS. *Toxopneustes semituberculatus* A. AGASS., 168.
tuberculatus AGASS. **Strongylocentrotus** *tuberculatus* BR. 165.
variegatus A. AGASS. *Toxopneustes variegatus* A. AGASS., 168.

Trachygaster POMEL, 1869.

Trachypatagus POMEL, 1869.

Trematopygus D'ORBIG. 1855.

Trigonocidaris A. AGASS. 1869.
albida A. AGASS. **Trigonocidaris albida** A. AGASS., 169.

Tripneustes AGASS. 1841.
angulosus DUJ. HUPÉ. *Hipponoë variegata* A. AGASS., 135.
bicolor VAL. PER. *Hipponoë variegata* A. AGASS., 135.
depressus A. AGASS. *Hipponoë depressa* A. AGASS., 134.
fasciatus DUJ. HUPÉ. *Hipponoë variegata* A. AGASS., 136.
fuscus MICH. *Hipponoë variegata* A. AGASS., 136.
obtusangulus AGASS. *Hipponoë variegata* A. AGASS., 136.
pentagonus AGASS. *Hipponoë variegata* A. AGASS., 135.
Peronii PERRIER. *Hipponoë variegata* A. AGASS., 136.
sardicus AGASS. *Hipponoë variegata* A. AGASS., 135.
senkenbergianus TROSCH. MS. *Hipponoë variegata* A. AGASS., 136.
subcoeruleus AGASS. *Hipponoë variegata* A. AGASS., 135.
ventricosus AGASS. *Hipponoë esculenta* A. AGASS., 135.
zigzag MICH. *Hipponoë variegata* A. AGASS., 136.

Tripylus PHIL. 1845.
australis PHIL. *Hemiaster australis* A. AGASS., 132.
cavernosus PHIL. *Hemiaster cavernosus* A. AGASS., 132.
excavatus PHIL. **Tripylus excavatus** PHIL., 169.
fragilis SARS. *Schizaster fragilis* AGASS., 157.
grandis TROSCH. **Faorina chinensis** GRAY, 129.
Philippii GRAY. *Schizaster Philippii* A. AGASS., 158.

Wrightia (**Pomel**), 1869 non AGASS. 1863.

Xanthobrissus A. AGASS. 1863.
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GEOGRAPHICAL DISTRIBUTION.

ALL that we know of the Geographical Distribution of marine animals is, with the exception of very contracted areas, limited to strictly littoral distribution. It is true that the Deep Sea Dredging Expeditions, since the laying of the Atlantic cable, have given us considerable additional information respecting the geographical distribution of marine life on the bottom of the northern part of the Atlantic, but that is as yet only sketched out roughly, though sufficiently to show us the probable mode of distribution of animals at different depths according to the temperature, forming tolerably well-defined belts, similar to the great belts of distribution of animals and plants as we ascend in altitude or in latitude, though the latter does not form apparently so important a part in the distribution of marine life as in the case of land animals and plants. On land, when we have alpine and arctic assemblages of similar animals and plants occurring in far distant geographical points (latitudinally distant), the identity of forms extends to but few types; while, as far as we can judge from the little we know of the inhabitants of the deeper parts of the Atlantic, the same species have a wide geographical range far exceeding any similar distribution on land. While on land we have a circumpolar arctic fauna extending with outliers at only comparatively short distances on the highest parts of the adjoining temperate tracts, we have probably an abyssal circumpolar marine fauna extending far into the tropics, surrounded at its lowest base (the littoral edges) by faunæ of the most diversified character, — a feature entirely unknown in the distribution of life upon the land. Of course we have the analogous feature of the change of life as we proceed in altitude in a mountain-chain, but that is a homologue of a similar change in marine life as we change the depth; and although we have something analogous to a well-characterized fauna surrounded by widely different elements east and west and north and south in the Rocky Mountains, yet we have nowhere such a diversified condition of life as we find in the littoral elements surrounding what at present we may call the Atlantic Realm, surrounded by the circumpolar littoral

fauna, — the Lusitanian, the West African, the Tropical Atlantic, and the American Boreal forming the base of life as it were of the Atlantic Realm. It is not a little remarkable that the point urged by Sars with so much force (in absence of evidence) against Lovén's theory of the distribution of life, — of a uniform fauna throughout the bottom of the deeper parts of the Atlantic, — should so soon have been disproved by actual exploration; the presence of Rhizocrinus lofotensis, Schizaster fragilis, Homolampas fragilis, Echinus norvegicus, Dorocidaris papillata, Echinocyamus pusillus, at such widely distant points and with such great bathymetrical range, shows that the theory proposed by Lovén gives, as far as we know, a rational explanation of many phenomena hitherto imperfectly understood in the distribution of marine life in the different bathymetrical belts. The explorations now going on under the auspices of the United States Coast Survey will probably extend our knowledge on this subject so materially that it seems useless to attempt any further exposition of the subject till their results are available, and I will limit myself, in discussing the geographical distribution of Echini, to strictly littoral divisions; not that I do not expect the material likely to be collected will not modify to some extent the limits assigned to the littoral divisions here sketched out, but in the main they are likely to be tolerably correct, if we may judge from the nature of the material thus far brought together in different public museums of Europe and America by the exploring expeditions sent at different times during this century by all the great continental nations. They have explored more or less thoroughly the shore lines at least of the greater part of the world, leaving but few spots about which we actually know nothing, so far at least as the distribution of Echini is concerned. It was, indeed, a matter of great surprise to find how few species of Echini hitherto not noticed were not to be found in the vast stores of the British Museum, the Jardin des Plantes, the Museums of Copenhagen, Stockholm, Berlin, Vienna. Everywhere, although from different localities, were found repetitions of species already well known, so that in making a map of the littoral regions we find but short stretches of shores completely unexplored. Of course additional species will undoubtedly turn up even in the best explored localities, but we have probably a very fair representation of the littoral Echini of the world.

In following out the geographical distribution of such a limited order as the Echini, we have the great advantage of being able to carry in our mind

the exact range of each species, and thus to see how far the limits of the littoral faunæ recognized among Mollusca by Forbes and Woodward, and among Crustacea by Dana, can be accepted for the Echini. Our limitation of a fauna seems as arbitrary as that of a geological period. We take a certain assemblage of animals at any special point, and, contrasting them with a different adjoining assemblage, frequently conclude that because we find differences we are entitled to consider this a different fauna. Such may or may not be the case on a more careful analysis of the range of the elements composing these two assemblages, but too often it will turn out, when carefully analyzed, that what we call a fauna is simply an overlapping of the range of two more distant faunæ, giving the intermediate district a peculiar physiognomy not always readily separable into its constituent elements, either from want of material or from imperfect identifications. It is frequently almost impossible to determine to which littoral district certain points belong, from the even balance held by the elements of the various districts found there. At the Cape Verde Islands we find a nearly equal number of species known to inhabit the Mediterranean, the West Indies, and tropical Africa; but there is no reason for making a special fauna of that part of the coast, any more than the mingling of the arctic species of the west coast of Norway with the Lusitanian, British, and even Mediterranean or Atlantic species, entitles the Scandinavian shores to rank as a littoral fauna. Nor does the presence of Arctic, West Indian, and boreal American species south of Cape Cod entitle that region to form a special littoral fauna. It has nothing peculiarly its own, as far as Echini are concerned, and is simply an assemblage of species ranging far beyond the limits which the greater number of species have. It is our ability thus to eliminate foreign elements which will give our divisions greater or less accuracy. Nor does the presence of Atlantic species along the Virginia and North Carolina coast, associated with West India species, entitle this region to be considered as a special faunistic littoral division. It is a very peculiar littoral district, as much so as the one immediately south of Cape Cod; but it is an assemblage of foreign elements which, although they apparently give to the coast of South Carolina, north and south, a very peculiar aspect, so far as its Echini fauna is concerned, is yet made up of species (component elements) having a very wide geographical distribution, and forming parts of totally different combinations. It may be useful to have names for these assemblages, but they have no biological value. At first glance the presence of

Echinarachnius parma on the east coast of North America strikes us as very characteristic of a Canadian fauna, yet when we remember that it is found on both sides of North America and on the east side of Asia, extending probably far south into the great Indo-Pacific Littoral Realm, we at once see that although we have on the east coast of North America several of these littoral assemblages, we have in reality only two faunæ, one the Circumpolar, the other the West Indian, which meet at Cape Cod, and by combination with the Pacific Boreal, the Lusitanian, the Atlantic, and the Mediterranean, form littoral assemblages which have thus far received the name of faunæ, but are evidently not entitled to it.

The Littoral Districts, which have been mapped out on *Pl. A* and *B*, are not made from any preconceived notions, but have been taken from the distribution of the several species of the annexed lists. We cannot fail to be struck with the remarkable coincidence of the great belts of temperature first mapped out by Dana, which are here copied from his map on the geographical distribution of Crustacea, and the approximate limits of many of our littoral districts, — an agreement which is still more striking when we come to examine the range of the principal genera.

The number of littoral districts recognized is considerably smaller than the number of provinces adopted by Forbes, Woodward, and Dana, the principal writers on the limits of marine geographical provinces. This is due in part to the smaller number of species of Echini, but the principal cause of the extensive range of so many species must be looked for in the influence of the currents.

The effect which currents play in shaping the geographical distribution of marine animals is very great; we have an example in the Gulf Stream and the northern branch of the Amazonian current flowing into the Gulf of Mexico, which account fully for the great range of the more common littoral species. The Japanese current makes itself felt as far as San Diego, two species of Echini extending in the Northern Pacific from the northern part of Japan along Kamtchatka, the Aleutian Islands, Sitka, Vancouver's Island, the one as far as Cape Mendocino (S. Dröbachiensis), the other (Echinarachnius excentricus) to San Diego. The Indo-Pacific equatorial current has undoubtedly been the main agent of the extensive geographical range of such species as Cidaris metularia, Echinonëus cyclostomus, Heterocentrotus mammillatus, Diadema setosum, Hipponoë variegata, Echinolampas oviformis, Brissus carinatus, Clypeaster humilis.

The effect of currents in thus extending the distribution of marine animals would act very differently upon the several classes of the animal kingdom, and its efficiency depends to a great extent upon the nature of their earlier stages, and upon their habits during that period. The time during which the Pluteus of Echini remains helpless at the mercy of the winds and currents is considerable; from early spring till late in the summer or fall is the usual time required for the full growth of the Pluteus in many species of Sea-urchins, and the distance which the young could thus be transported, even by a sluggish current, during a single season, must be considerable, even under the most unfavorable circumstances.

As many Echini are not affected by a great range of depth (1200 fathoms), and reproduce themselves frequently at the end of the third year, and even of the second year, after the resorption of the Pluteus, it is not astonishing the same species should be found in every extreme position of depth, latitude, and longitude.

Various writers have attempted to retrace, in former geological periods, the probable course of the currents and their effect upon the geographical distribution of marine animals; they all agree in representing, up to the Cretaceous period, an unbroken equatorial current, passing through Central Asia, Arabia, the northern part of Africa, and connecting with the Pacific by a narrow strait through the Isthmus of Panama. The existence of this connection in the Cretaceous period is placed beyond doubt by the presence of an Ananchytes, which I am unable to distinguish from Ananchytes radiata, collected on the Isthmus of Panama, and now in the possession of Yale College, kindly loaned me for examination by Professor Verrill. From the small number of identical species, either of Mollusca, Crustacea, or Fishes, recorded on both sides of the Isthmus, this connection must have been very imperfect at a comparatively recent geological period, — since the existence of the present faunæ.

The question naturally arises, Have we not in the different faunæ of both sides of the Isthmus a standard by which to measure the changes which these species have undergone since the raising of the Isthmus of Panama and the isolation of the two faunæ? If the upheaval of the Isthmus has been gradual, it must, of course, have cut off the deep-water species on both sides of the Isthmus, and gradually have isolated the more shallow, till the littoral species also became separated. As a natural consequence, the deeper we go, the farther back in time we must expect to find the representation,

— a result which is strikingly confirmed by the nature of the deep-water fauna of the West Indies. Unfortunately we have not, as in the case of the littoral faunæ, a standard of comparison. At the same time, with the gradual closing of the Isthmus of Panama, the greater part of Central Asia, of the Arabian Peninsula, and of Northern Africa was emerging from the sea, reducing the range of the equatorial current, and thus confining the course of the currents much as they are at the present time. This would thus cause a limitation in the range of the species formerly having the greatest distribution, and extend that of those which were more local.

If migration on land when continents were joined together, and subsequent variations after their isolation through submergence, has been the main agent in the distribution of the existing terrestrial faunæ, we must acknowledge a similar agency to currents in the distribution of marine faunæ; and by the submergence or rise of various portions of the continents, we shall be able, if we can trace these changes, to reconstruct within certain limits the altered courses of the main oceanic currents, and get some idea of the probable geographical distribution at different geological epochs. The greater the bathymetrical range of littoral species, the longer will such species remain unaffected, while deep-sea species may early become isolated and remain as outliers as it were, — mementoes of a former condition of currents, or even of a previous geological period. The careful analysis of the fauna of a given point, its comparison with other faunæ, and accurate bathymetrical data, would go far towards reconstructing the Natural History of the sea in former ages, and showing its relation to the present and past times.

The representative species of Echinus, Echinocardium, Brissopsis, Schizaster, in the Arctic and Antarctic boreal zones would be considered as the living representatives of a cosmopolitan fauna existing at the time when the great equatorial current flowed unbroken round the globe, sending branches north and south along Eastern North and South America, along Eastern Japan and Australia, and the Eastern Coast of Africa; while the tropical species of the genera Diadema, Clypeaster, Echinonēus, Echinolampas, etc., existing at that time, had a more limited equatorial geographical distribution. The subsequent period of isolation of Atlantic and Pacific currents is shown by the existence of truly Atlantic and Pacific species; while as we go down in depth we go back also in time, and find at first representatives of the genera found in our Tertiaries, while at greater depth the species are

representatives of genera found in the Cretaceous. A more detailed comparison than can be given here of the present faunæ with the fossils of the tertiary deposits, would be most interesting; but unfortunately the materials thus far collected are too fragmentary, and we must await deep-sea dredgings of a considerable extent of coast, before we shall have the data needed to follow up the important results to be gained in this way for palæontology and geography, of which our present incomplete materials give us such an interesting glimpse.

What we know of the Tertiaries of the West Indies and Alabama, of Malta and of India, shows that with the exception of the greater extension of Echinanthus, Eupatagus, Maretia, Scutella, Pygorhynchus, the North Atlantic fauna did not differ very materially from its present conditions. The same may be said of the American; while the Tertiaries of the East Indies show the presence of Temnopleurus, Pleurechinus, Heliocidaris, Rumphia, Breynia, Maretia,—genera which are still characteristic of the same districts.

As far as we can judge from the present geographical extension of the genera characteristic of the different great Marine Realms, we can only recognize four (*Pl. G*); the American, the coasts of the two sides of this continent (north and south), being characterized by Echinarachnius, Arbacia, Encope, Mellita, Hemiaster. The species of this realm extend as far as the Mediterranean and the West Coast of Africa, where they unite with the species of the North Atlantic Realm, Echinus, Sphaerechinus, Schizaster, Strongylocentrotus, Dorocidaris, Spatangus, Echinocyamus, Echinocardium, and extend along the Japanese coast to meet the great Indo-Pacific Realm; the Atlantic Realm extending through the Red Sea, Indian Ocean, to Japan, forming a belt of species, Schizaster, Sphaerechinus, Echinocardium, Spatangus, now disconnected from the North Atlantic Realm except by the circumpolar species, which, however, does not show the former association, through the Red Sea and North Africa, as well as the existence of the above-mentioned genera associated with thoroughly characteristic Indo-Pacific species. We must look upon the great extension of the genus Strongylocentrotus along the whole of the West Coast of North and South America and of Echinocardium as indicating a possible genetic connection between the species of the Arctic and Antarctic Seas.

The characteristic genera of the Indo-Pacific Realm are Phyllacanthus, Colobocentrotus, Heterocentrotus, Paraselenia, Fibularia, Echinostrephus, Laganum, Maretia. This realm is connected with the American Realm by the

genera Clypeaster, Echinanthus, Metalia, Cidaris, Diadema, Echinometra, and with the North Atlantic by the genera mentioned above, Echinocardium and Strongylocentrotus.

The fourth realm, the Australian, differs radically from the others, and remains more completely isolated from the other existing realms. Though it is associated by Centrostephanus and Breynia with the Indo-Pacific, and by Strongylocentrotus and Echinocardium with the North Atlantic Realm, the South Circumpolar District must be considered a part of this realm (by Goniocidaris canaliculatus), as we have looked upon the North Circumpolar District as a part of the North Atlantic Realm.

The principal Isochrymal Lines dividing the oceans into Frigid, Temperate, and Torrid are copied from Professor Dana's Isochrymal Lines, given by him on his valuable map of the Geographical Distribution of Crustacea, in his great work on the Crustacea of the United States Exploring Expedition.

PLATE A, contains the following Littoral Districts, — Pacific, Boreal American, West South American, Tropical Atlantic, West Africa, Indo-Africa, Indo-Pacific, North Circumpolar, Patagonia.

PLATE B, — Japanese, Australian, North Pacific, Panamic, North Atlantic, Lusitanian, South Circumpolar, East Indian, Californian.

PLATE G, shows the Distribution of the Oceans into four great Realms, — Atlantic Circumpolar, Australian Antarctic, Pacific, and American.

LIST OF THE KNOWN SPECIES OF ECHINI.

DESMOSTICHA HAECKEL.

CIDARIDAE MÜLL.

GONIOCIDARIDAE HAECKEL.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Cidaris KL.		
Cidaris metularia BL.	*Cidarites* **metularia** LAMK.	Red Sea; Mauritius; E. India Isls.; Sandwich Isls.; Feejee Isls.
Cidaris **Thouarsii** VAL.	*Cidaris* **Thouarsii** VAL.	Panama; Gulf of California.
Cidaris tribuloides BL.	*Cidarites* **tribuloides** LAMK.	Florida; Brazil; Cape Palmas.
Dorocidaris A. AGASS.		
Dorocidaris *papillata* A. AG.	*Cidaris* **papillata** LESKE.	Norway; Mediterranean; Fla.
Phyllacanthus BR.		
Phyllacanthus annulifera A. AG.	*Cidarites* **annulifera** LAMK.	Australia; Philippine Isls.
Phyllacanthus baculosa A. AG.	*Cidarites* **baculosa** LAMK.	Red Sea; Zanzibar; Mauri ius.
Phyllacanthus dubia BR.	**Phyllacanthus dubia** BR.	Zanzibar; Bonin Isls.; Australia.
Phyllacanthus gigantea A. AG.	**Chondrocidaris gigantea** A. AG.	Sandwich Isls.
Phyllacanthus *imperialis* BR.	**Cidaris Mauri**..... KL.	Red Sea; East India Isls.; Australia.
Phyllacanthus verticillata A. AG.	*Cidarites* **verticillata** LAMK.	Society Isls.; East India Isls.; Australia.
Stephanocidaris A. AGASS.		
Stephanocidaris bispinosa A. AG.	*Cidarites* **bispinosa** LAMK.	Australia; Malacca.
Porocidaris DES.		
Porocidaris **purpurata** W. THOM.	*Porocidaris* **purpurata** W. THOM.	Rockall.
Goniocidaris DES.		
Goniocidaris canalicuta A. AG.	*Temnocidaris* **canaliculata** A. AG.	Patagonia; Natal.
Goniocidaris *geranioides* AG.	*Cidarites* **geranioides** LAMK.	Australia; E. Indies.
Goniocidaris tubaria LÜTK.	*Cidarites* **tubaria** LAMK.	Australia; Tasmania.

SALENIDAE AGASS.

Salenia GRAY.		
Salenia varispina A. AG.	**Salenocidaris varispina** A. AG.	Straits of Florida.

ARBACIADAE GRAY.

Arbacia GRAY.		
Arbacia *Dufresnii* GRAY.	*Echinus* **Dufresnii** BL.	Patagonia; Chili.
Arbacia nigra A. AG.	*Echinus niger* (Mol.)	Patagonia; Chili; Peru.
Arbacia *punctulata* GRAY.	*Echinus* **punctulatus** LAMK.	Long Island Sound to W. Florida.
Arbacia *pustulosa* GRAY.	*Cidaris* **pustulosa** LESKE.	Mediterranean; Liberia; Brazil.
Arbacia spatuligera A. AG.	*Echinus* **spatuliger** VAL.	Chili; Peru.
Arbacia *stellata* GRAY.	*Echinus stellatus* (Bl.)	Panama; Gulf of California.
Podocidaris A. AGASS.		
Podocidaris sculpta A. AG.	**Podocidaris sculpta** A. AG.	Straits of Florida.
Coelopleurus AGASS.		
Coelopleurus **floridanus** A. AG.	*Coelopleurus* **floridanus** A. AG.	Straits of Florida.
Coelopleurus Maillardi A. AG.	**Keraiaphorus Maillardi** MICH.	Bourbon.

DIADEMATIDAE Peters.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Diadema Schynv.		
Diadema **mexicanum** A. Ag.	*Diadema* **mexicanum** A. Ag.	Acapulco; Cape St. Lucas.
Diadema setosum Gray.	*Cidarites diadema* Lamk.	W. India Isls.; Cape Verde Isls.; Indian Ocean; Japan; Sandwich Isls.; Feejee Isls.
Centrostephanus Pet.		
Centrostephanus coronatus A. Ag.	**Echinodiadema coronata** Ver.	Cape St. Lucas.
Centrostephanus *longispinus* Pt.	*Diadema* **longispina** Phil.	Palermo; Canary Isls.
Centrostephanus Rodgersii A. Ag.	**Trichodiadema Rodgersii** A. Ag.	Australia; New Caledonia.
Echinothrix Pet.		
Echinothrix calamaris A. Ag.	*Echinus* **calamaris** Pall.	Society Isls.; East India Isls.; Philippine Isls.
Echinothrix *Desorii* Pet.	*Astropyga* **Desorii** Agass.	Red Sea; Feejee Isls.; Sandwich Isls.
Echinothrix *turcarum* Pet.	**Diadema turcarum** Schynv.	Sandwich Isls.; Feejee Isls.; Japan; E. India Isls.; Red Sea; Zanzibar.
Astropyga Gray.		
Astropyga pulvinata Agass.	*Cidarites* **pulvinata** Lamk.	Panama; Gulf of California.
Astropyga *radiata* Gray.	*Cidaris* **radiata** Leske.	Zanzibar; East India Isls.; Philippine Isls.
Asthenosoma Grube.		
Asthenosoma hystrix A. Ag.	**Calveria hystrix** Thom.	Florida; Rockall to Rona.
Asthenosoma varium Grube.	**Asthenosoma varium** Grube.	China Seas.

ECHINOMETRADAE Gray.

Colobocentrotus Br		
Colobocentrotus *atratus* Br.	*Echinus* **atratus** Linn.	Zanzibar; Java; Sandwich Isls.
Colobocentrotus Mertensii Br.	**Colobocentrotus Mertensii** Br.	Bonin Isls.; Australia.
Heterocentrotus Br.		
Heterocentrotus *mammillatus* Br.	**Cidaris mammillata** Kl.	Sandwich Isls.; E. India Isls; Red Sea; Feejee Isls.
Heterocentrotus *trigonarius* Br.	*Echinus* **trigonarius** Lamk.	Mauritius; Java; Sandwich Isls.; Feejee Isls.
Echinometra Rondel. (Breyn.)		
Echinometra lucunter Bl.	*Cidaris lucunter* Leske.	Zanzibar; Red Sea; E. India Isls.; Japan; Sandwich Isls.; Feejee Isls.
Echinometra macrostoma A. Ag.	**Ellipsechinus macrostomus** Lütk.	
Echinometra oblonga Bl.	*Echinus* **oblongus** Bl.	Sandwich Isls.; Philippine Isls.; Seychelle Isls.
Echinometra subangularis Desml.	*Cidaris* **subangularis** Leske.	Senegal; Cape Verde; Brazil; W. India Isls.; Bermudas.
Echinometra **Van Brunti** A. Ag.	*Echinometra* **Van Brunti** A. Ag.	Peru; Panama; Gulf of Cal.
Echinometra **viridis** A. Agass.	*Echinometra* **viridis** A. Ag.	Florida; Hayti.
Parasalenia A. Agass.		
Parasalenia gratiosa A. Ag.	**Parasalenia gratiosa** A. Ag.	Kingsmills Isls.; Bonin Isls.; Zanzibar.
Stomopneustes Agass.		
Stomopneustes *variolaris* Ag.	*Echinus* **variolaris** Lamk.	Mauritius, Java; Samoa.
Strongylocentrotus Br.		
Strongylocentrotus albus A. Ag.	*Echinus* **albus** Mol.	Patagonia; Chili; Peru.
Strongylocentrotus **armiger** A. Ag.	*Strongylocentrotus* **armiger** A. Ag.	Australia.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Strongylocentrotus Br. (*continued*).		
Strongylocentrotus depressus A. Ag.	*Toxocidaris* **depressa** A. Ag.	Japan.
Strongylo. Dröbachiensis A. Ag.	*Echinus* **Dröbachiensis** Müll.	N. European; N. Pacific; N. E. Coast of America.
Strongylo. eurythrogrammus A. Ag.	*Echinus* **eurythrogrammus** Val.	Australia; Tasmania; Samoa.
Strongylo. franciscanus A. Ag.	**Toxocidaris franciscana** A. Ag.	Formosa; Puget Sd.; San Diego.
Strongylocentrotus Gaimardi A. Ag.	*Echinus* **Gaimardi** Bl.	Brazil.
Strongylocentrotus gibbosus A. Ag.	*Echinus* **gibbosus** Val.	Chili; Galapagos; Peru.
Strongylo. intermedius A. Ag.	*Psammechinus* **intermedius** Barn.	Japan.
Strongylocentrotus *lividus* Br.	*Echinus saxatilis* Lin.	Europ. Atlantic; Mediterranean; Azores.
Strongylocentrotus mexicanus A. Ag.	**Toxocidaris** *mexicana* **(A. Ag.)**	Gulf of California.
Strongylocentrotus nudus A. Ag.	*Toxocidaris* **nuda** A. Ag.	Sandwich Isls.; Japan.
Strongylo. purpuratus A. Ag.	*Echinus* **purpuratus** Stimps.	San Francisco; Puget Sound.
Strongylo. *tuberculatus* Br.	*Echinus* **tuberculatus** Lamk.	Japan; China; Australia; New Zealand.
Sphaerechinus Des.		
Sphaerechinus **Australiae** A. Ag.	*Sphaerechinus* **Australiae** A. Ag.	Australia; Mauritius; New Zealand.
Sphaerechinus granularis A. Ag.	*Echinus* **granularis** Lam.	Mediterranean; Canary Isls.
Sphaerechinus pulcherrimus A. Ag.	*Psammechinus* **pulcherrimus** Barn.	Japan; China Seas.
Pseudoboletia Trosch.		
Pseudoboletia granulata A. Ag.	*Boletia* **granulata** A. Ag.	Sandwich Isls.
Pseudoboletia indiana A. Ag.	*Toxopneustes* **indianus** Mich.	Philippine Isls: Mauritius.
Echinostrephus A. Agass.		
Echinostrephus molare A. Ag.	*Echinometra* **setosa** Rumph.	Society Isls.; Zanzibar; Natal.

ECHINIDAE Agass.

TEMNOPLEURIDAE Des.

Temnopleurus Agass.		
Temnopleurus Hardwickii A. Ag.	**Toreumatica Hardwickii** Gray.	Japan.
Temnopleurus **Reynaudi** Ag.	*Temnopleurus* **Reynaudi** Agass.	Ceylon; China Seas.
Temnopleurus *toreumaticus* Ag.	**Cidaris toreumatica** Kl.	Bombay; E. India Isls.; China.
Pleurechinus Agass.		
Pleurechinus *bothryoides* Ag.	**Pleurechinus** *bothryoides* Ag.	Galapagos. ? ?
Temnechinus Forbes.		
Temnechinus maculatus A. Ag.	**Genocidaris maculata** A. Ag.	Straits of Florida; Azores.
Microcyphus Agass.		
Mycrocyphus **maculatus** Ag.	*Microcyphus* **maculatus** Agass.	Japan; Navigator Isls.; East India Isls.
Microcyphus **zigzag** Ag.	**Cidaris bothryoides** Kl.	Japan; Philip. Isls.; Tasmania.
Trigonocidaris A. Agass.		
Trigonocidaris albida A. Ag.	**Trigonocidaris albida** A. Ag.	Straits of Florida.
Salmacis Agass.		
Salmacis bicolor Ag.	**Salmacis bicolor** Agass.	R'd Sea; Mozambique; Bombay.
Salmacis **Dussumieri** Ag.	*Salmacis* **Dussumieri** Agass.	China Seas.
Salmacis **globator** Ag.	*Salmacis* **globator** Ag.	Australia.
Salmacis **rarispina** Ag.	*Salmacis* **rarispinus** Agass.	Philippine Isls.; Siam; China Seas.
Salmacis **sulcata** Ag.	*Salmacis* **sulcatus** Agass.	Australia; Philippine Isls.; Mozambique; Red Sea.
Mespilia Des.		
Mespilia *globulus* Ag.	*Echinus* **globulus** Lin.	Japan; Philippine Isls.; Sandwich Isls.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Amblypneustes AGASS.		
Amblypneustes *griseus* AG.	*Echinus* **griseus** BL.	Australia; New Zealand.
Amblypneustes **formosus** VAL.	*Amblypneustes* **formosus** VAL.	Australia.
Amblypneustes ovum AG.	*Echinus* **ovum** LAMK.	Australia.
Amblypneustes pallidus VAL.	*Echinus* **pallidus** LAMK.	Australia; Feejee Isls.
Amblypneustes **pentagonus** A. AG.	*Amblypneustes* **pentagonus** A. AG.	Mauritius. ?
Holopneustes AGASS.		
Holopneustes inflatus A. AG.	*Amblypneustes* **inflatus** LÜTK.	New Holland.
Holopneustes **porosissimus** AG.	*Cidaris granulata* (**Agass.**)	New Holland.
Holopneustes purpurescens A. AG.	*Amblypneustes* **purpurescens** LÜTK.	New Holland.
	TRIPLECHINIDAE A. AGASS.	
Phymosoma HAIME.		
Phymosoma crenulare A. AG.	**Glyptocidaris crenularis** A. AG.	Japan.
Hemipedina WRIGHT.		
Hemipedina cubensis A. AG.	**Caenopedina cubensis** A. AG.	Straits of Florida.
Echinus ROND. (LINN.)		
Echinus **acutus** LAMK.	*Echinus* **acutus** LAMK.	Norway; Mediterranean.
Echinus angulosus A. AG.	*Cidaris* **angulosa** LEKSE.	Cape Good Hope; Mauritius; Red Sea; Philippines; New Zealand.
Echinus elegans DUB. o. KOR.	*Echinus elegans* (**Düb. o. Kor.**)	Norway; off Valencia; Mediterranean.
Echinus esculentus LIN.	*Echinus* **subglobosus** LINN.	Norway; English Channel.
Echinus **gracilis** A. AG.	*Echinus* **gracilis** A. AG.	Straits of Florida; St. Thomas.
Echinus **magellanicus** PHIL.	*Echinus* **magellanicus** PHIL.	Patagonia; Chili; New Zealand.
Echinus **margaritaceus** LAM.	*Echinus* **margaritaceus** LAMK.	Patagonia.
Echinus **melo** LAM.	*Echinus* **melo** LAMK.	Mediterranean.
Echinus **microtuberculatus** BL.	*Echinus* **microtuberculatus** BL.	Mediterranean; Cape Verde Isls.
Echinus **miliaris** MÜLL.	*Echinus* **miliaris** MÜLL. KN.	Norway; English Channel.
Echinus **norvegicus** DÜB. o. KOR.	*Echinus* **norvegicus** DÜB. o. KOR.	Norway; off Valencia; Mediterranean; Straits of Florida.
Toxopneustes AGASS.		
Toxopneustes maculatus A. AG.	*Echinus* **maculatus** LAMK.	Christmas Isl.; Bourbon.
Toxopneustes *pileolus* AGASS.	*Echinus* **pileolus** LAMK.	Panama; E. India Isls.; Feejee Isls.; Mauritius.
Toxopneustes semituberculatus AG.	*Echinus* **semituberculatus** VAL.	Galapagos; W. coast Cent. Am.; Cape St. Lucas.
Toxopneustes variegatus A. AG.	*Echinus variegatus* (**Lamk.**)	Bermudas; S. Carolina; W. India Isls.; Brazil.
Hipponoë GRAY.		
Hipponoë depressa A. AG.	*Tripneustes* **depressus** A. AG.	Gulf of California.
Hipponoë esculenta A. AG.	*Cidaris esculenta* (**Leske.**)	Florida; W. Indies; Surinam.
Hipponoë variegata A. AG.	*Cidaris* **variegata** LESKE.	Sandwich Isls.; Japan, E. India Isls.; Feejee Isls.; Red Sea; Mozambique.
Evechinus VERRILL.		
Evechinus *chloroticus* VERRILL.	*Echinus* **chloroticus** VAL.	New Zealand.

CLYPEASTRIDAE AGASS.

EUCLYPEASTRIDAE HAECKEL.

FIBULARINA GRAY.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Echinocyamus VAN PHELS.		
Echinocyamus pusillus GRAY.	**Spatagus pusillus** MÜLL.	Norway; Mediterr'an; Azores; Florida.
Fibularia LAMK.		
Fibularia **australis** DESML.	*Fibularia* **australis** DESML.	Sandwich Isls.; Japan; Australia.
Fibularia *ovulum* LAMK.	*Echinus* **minutus** PALL.	Indian Ocean; Philippine Isls.
Fibularia **volva** AGASS.	*Fibularia* **volva** AGASS.	Red Sea; Formosa; N. Australia.

ECHINANTHIDAE A. AGASS.

Clypeaster LAMK.		
Clypeaster humilis A. AG.	*Echinanthus* **humile** LESKE.	Red Sea; E. India Isls.; New Caledonia.
Clypeaster rotundus A. AG.	**Stolonoclypus rotundus** A. AG.	Panama; San Diego.
Clypeaster scutiformis LAMK.	*Echinus* **reticulatus** LIN. (pars.)	Red Sea; Philippine Isls.; Kingsmills Isls.
Clypeaster subdepressus AGASS.	*Echinanthus* **subdepressus** GRAY.	Florida; W. coast of Africa.
Echinanthus BREYN.		
Echinanthus rosaceus GRAY.	*Echinus* **rosaceus** LIN.	W. India Isls.; Florida.
Echinanthus **testudinarius** GRAY.	*Echinanthus* **testudinarius** GRAY.	Australia; Japan; Sandwich Isls.; Gulf of California.

LAGANIDAE DES. (Emend.)

Laganum KL.		
Laganum Bonani KL.	**Laganum Bonani** KL.	Tasmania; E. India Isls.; Philippine Isls.
Laganum **depressum** LESS.	*Laganum* **depressum** LESS.	Kingsmills Isls.; Feejee Isls; Philippine Isls.; Australia; Zanzibar.
Laganum **Putnami** BARN.	*Laganum* **Putnami** BARN.	Japan.
Peronella GRAY.		
Peronella decagonalis A. AG.	*Scutella* **decagonalis** BL.	Japan; New Caledonia; Bay of Bengal.
Peronella orbicularis A. AG.	*Echinodiscus* **orbicularis** LESKE.	New Holland; Formosa.
Peronella *Peronii* GRAY.	*Laganum* **Peronii** AGASS.	Tasmania; Philippine Isls.
Peronella rostrata A. AG.	*Laganum* **rostratum** AGASS.	New Zealand; Zanzibar.

SCUTELLIDAE AGASS.

Echinarachnius LESKE.		
Echinarachnius excentricus VAL.	*Scutella* **excentrica** ESCH.	California; Kamtchatka.
Echinarachnius mirabilis A. AG.	**Scaphechinus mirabilis** A. AG.	Japan.
Echinarachnius parma GRAY.	**Scutella parma** LAMK.	New Jersey; Labrador; Vancouver Isl.; Kamtchatka.
Arachnoides KL.		
Arachnoides placenta AGASS.	*Echinus* **placenta** LIN.	New Zealand; Australia; East India Isls.; Burmah.
Echinodiscus BREYN.		
Echinodiscus **auritus** LESKE.	*Echinodiscus* **auritus** LESKE.	Zanzibar; Philippine Isls.
Echinodiscus biforis A. AG.	*Echinodiscus* **bisperforatus** LESKE.	Mozambique; Red Sea; Java.
Echinodiscus laevis A. AG.	**Mellita laevis** KL.	Japan; New Caledonia; East India Isls.; S. Africa.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Mellita Kl.		
Mellita **erythraea** Gray.	*Mellita* **erythraea** Gray.	Red Sea.?
Mellita **longifissa** Mich.	*Mellita* **longifissa** Mich.	Panama; Gulf of California.
Mellita **pacifica** Verrill.	*Mellita* **pacifica** Verrill.	Peru.
Mellita sexforis A. Ag.	*Echinus* **hexaporus** Gmel.	W. India Isls.
Mellita Stokesii A. Ag.	*Encope* **Stokesii** Agass.	Guayaquil; Panama.
Mellita testudinata Kl.	**Mellita testudinata** Kl.	Brazil; W. India Isls; North and South Carolina.
Astriclypeus Verrill.		
Astriclypeus Manni Verrill.	**Astriclypeus Manni** Verrill.	China; Japan.
Rotula Kl.		
Rotula Augusti Kl.	**Rotula Augusti** Kl.	Liberia.
Rotula Rumphii Kl.	**Rotula Rumphii** Kl.	Senegal; Cape Verde Isls.
Encope Agass.		
Encope **californica** Verrill.	*Encope* **californica** Verrill.	Gulf of California.
Encope emarginata Agass.	*Echinodiscus* **emarginatus** Leske.	Brazil; West Indies.
Encope grandis Agass.	**Encope grandis** Agass.	Gulf of California.
Encope **Michelini** Agass.	*Encope* **Michelini** Agass.	Yucatan; Florida.
Encope **micropora** Agass.	*Encope* **micropora** Agass.	Panama; Gulf of California.

PETALOSTICHA Haeckel.

CASSIDULIDAE Agass.

ECHINONIDAE Agass.

Echinonëus Van Phel.		
Echinonëus **cyclostomus** Leske.	*Echinoneus* **cyclostomus** Leske.	Australia; Kingsmills Isls.; Zanzibar.
Echinonëus semilunaris Lamk.	*Echinus* **semilunaris** Gmel.	Florida; W. India Isls.

NUCLEOLIDAE Agass.

Neolampas A. Agass.		
Neolampas rostellata A. Ag.	**Neolampas rostellatus** A. Ag.	Straits of Florida.
Echinolampas Gray.		
Echinolampas **depressa** Gray.	*Echinolampas* **depressus** Gray.	Straits of Florida.
Echinolampas **Hellei** Val.	*Echinolampas Richardi* (Desml.)	Senegal.
Echinolampas *oviformis* Gray.	**Scutum ovatum** Kl.	Red Sea; Molucca.
Rhynchopygus D'Orbig.		
Rhynchopygus caribaearum Lütk.	**Cassidulus caribaearum** Lamk.	W. India Isls.
Rhynchopygus pacificus A. Ag.	*Pygorhynchus* **pacificus** Ag.	Galapagos; Panama; Gulf of California.
Echinobrissus Breyn.		
Echinobrissus recens D'Orb.	*Nucleolites* **recens** Edw.	New Zealand; Madagascar.
Nucleolites Lamk.		
Nucleolites **epigonus** Mart.	*Nucleolites* **epigonus** Mart.	E. India Isls.
Anochanus Grube.		
Anochanus sinensis Grube.	**Anochanus sinensis** Grube.	East India Isls.

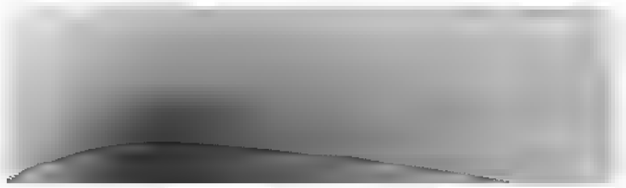
SPATANGIDAE Agass.

ANANCHYTIDAE Alb. Gras.

Pourtalesia A. Agass.		
Pourtalesia miranda A. Ag.	**Pourtalesia miranda** A Ag.	Straits of Florida; Shetland Channel.
Homolampas A. Agass.		
Homolampas *fragilis* A. Ag.	*Lissonotus* **fragilis** A. Ag.	Straits of Florida.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Platybrissus GRUBE.		
Platybrissus Roemeri GRUBE.	**Platybrissus Roemeri** GRUBE.	
	EUSPATANGINA A. AGASS.	
Spatangus KL.		
Spatangus **Lütkeni** A. AG.	*Spatangus* **Lütkeni** A. AG.	Japan.
Spatangus purpureus LESKE.	**Spatagus purpureus** MÜLL.	Norway; Mediterranean.
Spatangus **Raschi** LOVÉN.	*Spatangus* **Raschi** LOVÉN.	German Ocean; Azores; off Valencia.
Maretia GRAY.		
Maretia **alta** A. AG.	*Maretia* **alta** A. AG.	Japan.
Maretia *planulata* GRAY.	*Spatangus* **ovatus** LESKE.	Kingsmills Isls.; China; East India Isls.; New Caledonia; Mauritius.
Eupatagus AGASS.		
Eupatagus Valenciennesii AG.	**Eupatagus Valenciennesii** AG.	Australia.
Lovenia DES.		
Lovenia **cordiformis** LÜTK.	*Lovenia* **cordiformis** LÜTK.	Guyaquil; Gulf of California.
Lovenia elongata GRAY.	*Spatangus* **elongatus** GRAY.	Red Sea; Australia; Philippine Isls.
Lovenia subcarinata GRAY.	*Spatangus* **subcarinatus** GRAY.	China; Luzon; Japan; Sandwich Isls.
Breynia DES.		
Breynia Australasiae GRAY.	*Spatangus* **Australasiae** LEACH.	Red Sea; Australia; Japan.
Echinocardium GRAY.		
Echinocardium **australe** GRAY.	*Echinocardium* **australe** GRAY.	New Zealand; Japan; E. India; Cape Good Hope.
Echinocardium cordatum GRAY.	*Echinus* **cordatus** PENN.	Norway; Mediterranean; Brazil; Florida.
Echinocardium flavescens A. AG.	**Spatagus flavescens** MÜLL.	Norway; S. Carolina; Florida.
Echinocard. mediterraneum GRAY.	*Amphidetus* **mediterraneus** FORB.	Mediterranean.
Echinocard. **pennatifidum** NORM.	*Amphidotus gibbosus* (**Barrett**).	Northumberland; Straits of Fla.
	LESKIADAE GRAY.	
Paleostoma LOVÉN.		
Paleostoma *mirabilis* LOVÉN.	*Leskia* **mirabilis** GRAY.	China; East India Isls.
	BRISSSINA GRAY.	
Hemiaster DES.		
Hemiaster australis A. AG.	**Tripylus australis** PHIL.	Patagonia.
Hemiaster cavernosus A. AG.	**Tripylus cavernosus** PHIL.	Patagonia; Chili.
Tripylus PHIL.		
Tripylus excavatus PHIL.	**Tripylus excavatus** PHIL.	Patagonia.
Rhynobrissus A. AGASS.		
Rhynobris. pyramidalis A. AG.	**Rhynobrissus pyramidalis** A. AG.	China.
Brissopsis AGASS.		
Brissopsis luzonica A. AG.	**Kleinia luzonica** GRAY.	Luzon; Siam; New Caledonia.
Brissopsis lyrifera AGASS.	*Brissus* **lyrifer** FORBES.	Norway; Mediter'an; Florida.
Agassizia VAL.		
Agassizia **excentrica** A. AG.	*Agassizia* **excentrica** A. AG.	Florida Gulf Stream.
Agassizia scrobiculata VAL.	**Agassizia scrobiculata** VAL.	Panama; Gulf of California.
Brissus KL.		
Brissus carinatus GRAY.	*Spatangus* **carinatus** LAMK.	Society Isls.; Sandwich Isls.; East Indies; Mauritius; Philippine Isls.

NAME ADOPTED.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Brissus **obesus** VERRILL.	*Brissus* **obesus** VERRILL.	Panama; Gulf of California.
Brissus unicolor KL.	**Brissus unicolor** KL.	West India Isls.; Cape Verde Isls.; Mediterranean.
Metalia GRAY.		
Metalia africana A. AG.	*Plagionotus* **africanus** VERRILL.	Sherboro Isls.
Metalia maculosa A. AG.	*Echinus* **maculosus** GMEL.	Samoa; Sandwich Isls.; Austr'a; Mauritius; Panama.
Metalia pectoralis A. AG.	*Echinus* **grandis** GMEL.	W. India Isls.; Florida.
Metalia *sternalis* GRAY.	*Spatangus* **sternalis** LAMK.	Sandwich Isls.; Society Isls.; E. India Isls.; Philippine Isls.; Australia; N. Caledonia; Red Sea.
Meoma GRAY.		
Meoma grandis GRAY.	**Meoma grandis** GRAY.	Acapulco; Gulf of California.
Meoma ventricosa LÜTK.	*Spatangus* **ventricosus** LAMK.	W. India Isls.
Linthia MER.		
Linthia australis A. AG.	*Desoria* **australis** GRAY.	Tasmania.
Faorina GRAY.		
Faorina chinensis GRAY.	**Faorina chinensis** GRAY.	China.
Schizaster AGASS.		
Schizaster canaliferus AGASS.	*Echinus* **lacunosus** LIN.	Mediterranean.
Schizaster fragilis AGASS.	*Brissus* **fragilis** DÜB. o. KOR.	Norway; Gulf St. Lawrence; Straits of Florida.
Schizaster **gibberulus** AGASS.	*Schizaster* **gibberulus** AGASS.	Red Sea.
Schizaster Philippii A. AG.	*Tripylus* **Philippii** GRAY.	Patagonia.
Schizaster **ventricosus** GRAY.	*Schizaster* **ventricosus** GRAY.	Feejee Isls.; Philippines; Siam.
Moira A. AGASS.		
Moira *atropos* A. AG.	*Spatangus* **atropos** LAMK.	West Indies; N. & S. Carolina.
Moira *clotho* A. AG.	*Moera* **clotho** MICH.	Gulf of California.
Moira *stygia* A. AG.	*Moera* **stygia** LUTK.	? Red Sea; Zanzibar. ?



LITTORAL DISTRICTS.

North Pacific (*Pl. B*) and Boreal American Districts (*Pl. A*).

The North Pacific District extends from the Sea of Okhotchk to the Gulf of Georgia, and some of its species even to San Diego. Echinarachius excentricus is found on the American and Asiatic sides of the Pacific, and in the same localities as the North Circumpolar species (*Pl. B*), S. Dröbachiensis.

E. excentricus extends to San Diego, and as far as the Gulf of Georgia is found associated with E. parma, an eminently boreal American (*Pl. A*) species, which however goes far south on the Asiatic side of the Pacific, even to the East India Islands, if we can credit the localities, across the whole of the Japanese and Chinese Districts, and is besides eminently characteristic of the northeastern coast of North America associated with the North Circumpolar species S. Dröbachiensis.

Californian, Panamic, and West South American Districts.

The true Californian (*Pl. B*) fauna, extending from the Santa Barbara Channel Islands to the Gulf of Georgia, lapping the North Pacific and the Circumpolar species, is poor in species, Strongylocentrotus franciscanus and S. purpuratus being thus far the only species known on that extensive stretch of coast strictly peculiar to it. The southern boundary of this fauna merges into the northern extremity of a more varied coast, the Panamic (*Pl. B*), extending from the northern part of Peru to the Santa Barbara Channel, though many of the species have thus far not been traced beyond Cape St. Lucas. Like the Japanese and Chinese fauna, it is made up of generic elements from the adjoining districts, the Indo-Pacific, Peruvian, Panamic, East Indian, Australian, West Indian, all being represented, the former by the presence of such species as Astropyga pulvinata, Toxopneustes pileolus, Lovenia cordiformis, and Metalia maculosa; the Peruvian by the presence of Agassizia, and the species of Arbacia; the strictly Panamic species being for the greater part representatives of the West Indian types; the East Indian having in common a species of Echinanthus, and the Australian the genus Centrostephanus. The (Peruvian) West South American (*Pl. A*) fauna extending from the northernmost part of Ecuador, lapping the Panamic District, extends to the southernmost limit of Chili, two of the species even ex-

tending to Cape Horn and the Straits of Magellan. This district probably includes the Galapagos, which, as far as is accurately known, have about an equal number of Peruvian and Panamic species. Many of the species generally credited to the Galapagos Islands are not known positively to live there. The Peruvian District is remarkable for the great development the Arbaciadae take, the other species being representatives of genera found in the West Indian District, one of the species extending to Australia, and, as I am informed by Dr. Semper (if there is no error in the locality), two of the species extend to the southern extremity of the Philippine Islands.

Patagonian District (*Pl. A*).

As far as known, the species of Echini of the southern extremity of South America are, with few exceptions, peculiar to it. We find three or four Peruvian species extending through the Straits of Magellan, and a few species extending from the mouth of the La Plata on the Atlantic, around the Horn to the coast of Chili, so that, to judge from positive evidence, the extremity of South America forms a district lapping on the Pacific side the Peruvian District (*Pl. A*), and extending on the Atlantic side to the southern extremity of the Tropical Atlantic District (*Pl. A*), of which some of the species reach the southern limit of Brazil, the coast gradually becoming poorer and poorer in species as we go south from the West India Islands, while towards the southern extremity of the continent a remarkable fauna occurs, resembling to a certain extent the combination of species found on the West Coast of Norway, in the North Atlantic District (*Pl. B*):—

Echinus margaritaceus,	Echinus norvegicus,
Echinus magellanicus,	Echinus miliaris,
Goniocidaris canaliculata,	Dorocidaris papillata,
Strongylocentrotus albus,	Strongylocentrotus Dröbachiensis,
Hemiaster australis,	Brissopsis lyrifera,
Schizaster Philippii,	Schizaster fragilis.

Goniocidaris canaliculata appears, if the localities are correct, to have a most extensive geographical distribution, being found at the Sandwich and Navigator Islands, Natal and Falkland Islands, and with Echinocardium australe, which has a somewhat similar range along the southern extremities of all the southern continents, and extending even north of the equator to Japan, form the characteristic species of the great Southern Circumpolar Belt (*Pl. B*).

Tropical Atlantic District (*Pl. A*).

It would be highly interesting to have sufficient data on the bathymetrical range of the species inhabiting the Atlantic to arrive, by a careful comparison of the species found on both sides, at some definite conclusion regarding the influence which depth and temperature have upon the distribution of species. Unfortunately, we can make but very limited comparisons. In spite of the zealous investigations of the elder and younger Sars on the coast of Norway, the Dredging Reports of McAndrew and Barrett and of Normann, and lastly the data furnished by the Porcupine Expedition from the European coasts, we have on our own coasts such a limited range for comparison that any conclusions can be but hints for future use. The identity of several species of the Echini from Florida and the coast of Norway confirmed in a remarkable manner the suggestion first made by Lovén of the possibility of finding in the warmer seas, at great depths, arctic species, the most striking confirmation being the existence of Rhizocrinus at great depths off Florida, off the Azores, on the coast of Portugal, and off Norway. Yet when we come to make a more detailed comparison of the species found on both sides of the Atlantic, we find some of them having such an extraordinary range in depth that, on either side, the extremes were far beyond the effect of any influence, due either to pressure or to temperature. Such were, for instance, Echinocyamus pusillus, Echinocardium cordatum and ovatum; while Brissopsis lyrifera, Dorocidaris papillata, Echinus norvegicus, Asthenosoma hystrix, Pourtalesia, Homolampas, and Schizaster fragilis occur only at such depth in the Straits of Florida as show that temperature and not depth is the main agent in the distribution of the species of Echini over the bottom of the Atlantic. The temperature being dependent upon the action of the sun only to moderate depth, it follows that we reach comparatively soon a depth below which the temperature is comparatively uniform, near the zero point; this uniform tempera e probably extending over the greater part of the bottom of the ocean, at depths varying with the latitude. The cold bottom connecting opposite shores in the North Atlantic is probably inhabited only by more or less arctic species, having an extraordinary wide geogra hical range, and corresponding to the arctic character of the fauna and flora of mountain chains and high summits. The only difference between the land and sea being that the ranges of variations of temperature are so small, we cannot

expect to find as great a number of different belts of organized beings as we find on land as we rise in altitude or in latitude. The tabulation of the range of the species thus far found in Florida shows a very wide range in (height) depth, in a comparatively narrow belt of variation of temperature. The species which characterize a local fauna are very limited in depth, while, as a general thing, they have a wide geographical distribution, as will be seen by an examination of the species which eminently characterize the littoral fauna of the West Indies or of the West Coast of Europe, which very soon merge (after two or three intermediate belts) into the deep-water (cold area) fauna of the North Atlantic. The species characteristic of the deep waters of Florida, thus far not found extending to the other side of the Atlantic, are Coelopleurus floridanus, Salenia varispina, Podocidaris sculpta, Trigonocidaris albida, Echinus gracilis, Echinolampas depressa, and Agassizia excentrica. Of the truly littoral species of the Tropical Atlantic District, some of them range from North Carolina, and even New Jersey and Long Island Sound, to the southern extremity of Brazil; a greater number extend from South Carolina to Brazil; a still greater number from Florida to Brazil; while from Florida to the northern part of Brazil we find the strictly West Indian fauna (Tropical Atlantic District) sending out its feelers to the Mediterranean, to the Platte River, to the Bermudas, and to the West African Coast, while some of the deep-water (cold area) species are found in the Gulf of St. Lawrence, the Azores, Shetland Islands, Mediterranean, and West Coast of Norway. Two species, Encope Michelini and Moira atropos, seem to be specially characteristic of the mainland, and thus far extend but a short distance south from Mexico, and do not reach farther north, the one than the Florida Keys, the other than North Carolina; they are on that part of the coast always accompanied by Arbacia punctulata, which thus far has not been found in the West Indies, except on the coast of Cuba and in the Straits of Florida.

The American North Atlantic Coast from New Jersey to Hudson's Bay is inhabited by species belonging in part to the North Atlantic District (*Pl. B*) and the Boreal American (*Pl. A*), and in part to the Tropical Atlantic District (*Pl. A*). One of the species, Echinarachnius parma, is found not only on the Atlantic side of America, but extends from the Straits of Behring along the Aleutian Islands and on the Pacific Coast as far south as the East India Islands. Of the Tropical Atlantic species, Arbacia punctulata extends to the southern extremity of Cape Cod; this is also the limit of Mel-

lita testudinata and of Toxopneustes variegatus.* Of the northern species, the southern limit of Echinarachnius parma is the coast of New Jersey, while Strongylocentrotus Dröbachiensis, the Circumpolar species, is sometimes found as far south as Cape Florida. Of the strictly North Atlantic species, Echinocyamus pusillus does not seem to extend farther west than Iceland, and has thus far not been found on the eastern coast of the United States except in Florida; Brissopsis lyrifera extends as far as Greenland; and Schizaster fragilis as far as the Gulf of St. Lawrence. Of the European Atlantic species, Echinus sphaera extends westward to Iceland.

North Atlantic District (*Pl. B*).

On the European side of the Atlantic the Circumpolar species, Strongylocentrotus Dröbachiensis, does not reach as far south as on the American side, being rarely found south of the English Channel. The range of some of the species — Cidaris papillata, Spatangus purpureus, Echinus acutus, elegans, norvegicus, Echinocyamus pusillus, Echinocardium cordatum, Brissopsis lyrifera — is quite extensive, overlapping as they do the Circumpolar species on the West Coast of Norway, as far north as the Lofoten Islands (in deep water), and even up to North Cape, and stretching thence along the Atlantic shores of Europe, throughout the whole range of the Mediterranean and the Adriatic; all these species, except Spatangus purpureus, E. acutus, and E. elegans, extend across the Atlantic to the deeper waters of Florida and the West India Islands (Guadaloupe), in conjunction with Asthenosoma hystrix, Pourtalesia miranda, Echinocardium pennatifidum, ovatum, and Schizaster fragilis, which as far as known do not extend into the Mediterranean or Adriatic. The strictly European Atlantic species are Echinus sphaera, Echinus miliaris, Spatangus Raschi; they extend along the Atlantic coast, one of the species as far as the Azores, up to the British Islands and Norway, but they are not found in the Mediterranean.

Sphaerechinus granularis, a strictly Mediterranean species, extends north as far as the West Coast of France, and south to the Cape Verde Islands, and westward to the Azores. The same range is also occupied by Strongylocentrotus lividus and Arbacia pustulosa, but they both extend to the other side of the Atlantic, and are found in Brazil associated with the West Indian species.

* Teste Verrill.

Lusitanian District (*Pl. B*).

Leaving the North Atlantic District, we come to the strictly Mediterranean species, consisting of Centrostephanus longispinus, Echinus microtuberculatus, Sphaerechinus granularis, Echinus melo, Echinocardium mediterraneum, and Schizaster canaliferus, overlapping to the north, as far as the Portuguese Coast, and even, for some species, as far as the English Channel, the North Atlantic European fauna, stretching westward as far as the Azores, and to the south as the Cape Verde Islands. Many of the species of the Lusitanian District occur at the Cape Verde Islands with strictly tropical African species, and a few of the West Indian species, extending to the Atlantic Coast of West Africa, and combining with the North Atlantic species found at the Azores, in the Mediterranean, and the Atlantic Coast of West Africa, give to the Lusitanian District, north and south of the Straits of Gibraltar, an extremely mixed character.

The West Indian species are Cidaris tribuloides (Diadema setosum cosmopolitan), Echinometra subangularis, Clypeaster subdepressus. Strongylocentrotus lividus and Arbacia pustulosa belong also to the Mediterranean species, but extend farther north and south than the purely Mediterranean species, and also reach across to Brazil.

The North Atlantic and West European species which extend into this district have already been enumerated.

West African District (*Pl. A*).

Of the Tropical Atlantic African District we know as yet too little to say anything very definite of its range. The existence of two species of Rotula and an Echinolampas, combined with Mediterranean species, as well as West Indian species to the North, is all we know, while the southern limit of this district is as yet entirely undefined, and the coast between the equator and the Cape of Good Hope is completely *terra incognita*. The only thing we know of that district is the presence of Echinometra subangularis at St. Helena and Ascension, but these islands are not sufficiently close to the mainland to give us any clew to the character of the Echini found there.

South Circumpolar District (*Pl. B*).

The southern extremity of Africa is characterized by a very small number of species, the northwestern limit of which is entirely unknown, while the

northeastern limit is soon reached at Natal, the species which characterize the great Indo-Pacific Belt and the Indian District extending as far south as that.

Echinus subangulosus and Echinocardium australe, two of the characteristic species of the district, extend to a great distance, in one case as far as the Nikobar Islands, while Echinocardium australe is, with the exception of the southern extremity of South America, found in the great Antarctic Belt, extending from New Zealand to the Cape of Good Hope, and even passing the equator and extending to Japan, in a similar manner to the extension of Echinocardium cordatum from Norway to Bahia. Echinometra lucunter extends on the eastern coast of Africa very far south, while Diadema setosum, a cosmopolitan species, unites the West African and the Indo-Pacific Districts.

Another species is also found there, which is an antarctic type, Goniocidaris canaliculata; this thus far is the only southern Circumpolar species found, and, like E. australe, extends far north, being found at Zanzibar, Sandwich Islands, and Navigator Islands, if the localities are to be trusted.

Indo-Pacific District (*Pl. A*).

In the great Indo-Pacific Belt the range of the species is very extensive. It is characterized as a distinct belt, not only by its Echinoderms, but also by its other Radiates, Mollusca, and Articulates. Better explored, as far as its littoral fauna is concerned, than the corresponding parts of the Atlantic Ocean, this belt extends on both sides of the equator in the Pacific, reaching from the Sandwich Islands to the East Coast of Africa, comprising the Low Archipelago, the Feejee and Navigator Islands, the north part of New Zealand, New Caledonia, New Guinea, the north shore of Australia, the whole of the East Indian Archipelago, the Bay of Bengal, the Arabian Sea, the Red Sea, and the East Coast of Africa as far as Natal, including the Seychelles, Mascerene Islands, and Madagascar, and extending north as far as the Philippines, the Bonin Islands, and the southern extremity of Japan. This great Indo-Pacific Belt encroaches upon the Australian District in New Zealand, and the western and eastern coast of Australia, upon the Chinese and Japanese District, and touches the west coast of Central America in the Panamic District, while the Indo-African District, as well as the East Indian and Pacific Districts, are both contained within the limits of this great belt.

The Indo-Pacific species having the most extensive range are:—

Cidaris metularia,
Phyllacanthus dubia,
Phyllacanthus verticillata,
Diadema setosum,
Echinothrix turcarum,
Echinothrix calamaris,
Echinothrix Desorii,
Heterocentrotus mammillatus,
Colobocentrotus atratus,
Echinometra lucunter,
Echinometra oblonga,
Parasalenia gratiosa,
Echinostrephus molare,
Hipponoë variegata,
Toxopneustes pileolus,
Clypeaster scutiformis,
Laganum depressum,
Echinonëus cyclostomus,
Maretia planulata,
Brissus carinatus,
Metalia sternalis,
Metalia maculosa.

There is a set of species which range as far in longitude, but do not extend as far north in latitude, having thus far not yet been found extending to any considerable degree north of the equator, and being absent in the Sandwich Islands and the Bonin Islands, though they are found as far east as the Low Islands in the South Pacific, and have also the same general southern limits as the preceding species. They are: —

Phyllacanthus baculosa,
Phyllacanthus imperialis,
Stomopneustes variolaris,
Heterocentrotus trigonarius,
Salmacis Dussumieri,
Fibularia volva,
Clypeaster humilis,
Peronella rostrata,
Nucleolites recens.

Indo-African District (*Pl. A*).

The species which are eminently characteristic of the East Coast of Africa and of the Indo-African District (*Pl. A*) are few; they extend as far as the West Coast of Australia, to the East Indian Archipelago, and even to the southern part of Japan. These are Echinodiscus auritus, E. laevis and biforis, Echinolampas oviformis, Salmacis sulcata and bicolor. With the exception of Schizaster gibberulus, Moira stygia, and Mellita erythrea, the Red Sea is inhabited by the species of the Indian Ocean and of the Indo-Pacific Belt.

Metalia maculosa, Toxopneustes pileolus, and Echinanthus testudinarius extend as far as the West Coast of Central America.

East Indian District (*Pl. B*).

The species belonging strictly to this district, some of which extend as far south and east as the Feejee Islands and New Caledonia, westward to the Persian Gulf, and northward to the southern coast of Japan, are: —

Phyllacanthus annulifera,
Temnopleurus toreumaticus,
Temnopleurus Reynaudi,
Microcyphus maculatus,
Pseudoboletia indiana,
Salmacis rarispina,
Peronella Lesueuri,
Arachnoides placenta,
Nucleolites epigonus,
Anochanus sinensis,
Brissopsis luzonica,
Paleostoma mirabilis,
Faorina chinensis,
Schizaster ventricosus.

Of these species, many lap over the northern limits of the Australian District, extend into the Indo-Pacific District, ranging along the Chinese and Japanese coasts, and encroach extensively upon the Indo-African District; they have been enumerated already.

Pacific District (*Pl. A*).

The strictly Pacific (*Pl. A*) species which do not extend to the westward of the East India Archipelago, and but little north or south of the equator, but many reach eastward as far as the Paumotu Islands, are:—

Phyllacanthus gigantea,
Colobocentrotus Mertensii,
Strongylocentrotus nudus,
Pseudoboletia granulata,
Toxopneustes maculatus,
Mespilia globulus,
Fibularia australis,
Laganum Bonani,
Lovenia subcarinata.

Japanese District (*Pl. B*).

The Japano-Chinese District is remarkable for the large number of species of Strongylocentrotus which take there a great development, some of the species of the genus extending far south along the eastern coast of Australia. True species of Echinus also inhabit the coast, while the association of the species of the District with such Indo-Pacific species as Hipponoë variegata, Echinometra lucunter, Toxopneustes pileolus, Laganum depressum, Maretia planulata, and Echinodiscus laevis, almost conceals the small number of species which characterize this peculiar region. There are, in addition to the species of Strongylocentrotus and of Echinus, Temnopleurus Hardwickii, Phymosoma crenulare, Asthenosoma varium, Astriclypeus Manni, Echinarachnius mirabilis, and Lovenia subcarinata, several of the species found on the East Coast of Africa having their easternmost range on the southern part of the coast of China. Several of the species extend to the Sandwich Islands.

Australian District (*Pl. B*).

By far the most typical of all the districts is the Australian, so peculiar that we might be tempted to consider the fauna of Echini as belonging to a different period, were they not contemporaries of some of the species of the Indo-Pacific, East Indian, Japanese, and of the Indo-African Districts, from all of which there are species extending far into the Australian District. This region includes also the New Zealand Islands; they have one or two species thus far limited to the northern islands, which have not yet been found on the Australian coast, — Laganum rostratum and Evechinus chloroticus.

The characteristic feature of the Australian District is the existence of so many species of Amblypneustes and Holopneustes, genera remarkably limited in their geographical distribution. The typical species are: —

Goniocidaris geranioides,
Goniocidaris tubaria,
Stephanocidaris bispinosa,
Centrostephanus Rodgersii,
Salmacis globator,
Holopneustes porosissimus,
Holopneustes inflatus,
Holopneustes purpurescens,
Amblypneustes pallidus,
Amblypneustes griseus,
Amblypneustes ovum,
Amblypneustes formosus,
Eupatagus Valenciennesii,
Breynia Australasiae,
Linthia australis.

Holopneustes and the succeeding genera were formerly represented in the Nummulitic Period of India, and the Tertiaries of Europe; they have, however, totally disappeared from the European seas.

North Circumpolar District (*Pl. A*).

This district is characterized by a single species only, — S. Dröbachiensis. It extends far into the North Atlantic District, and is associated on the American shores with the Boreal American and the North Pacific species, lapping part of the Japanese and Californian Districts, and extending to the Lusitanian District on the European shores.

LITTORAL LISTS.

The accompanying Lists will show how far the Geographical Districts which have been recognized are natural. The lists are not culled to show the characteristic species of each district; on the contrary, all the species occurring within a given range of coast are included; and as the range of each species in the district is always given, it will be an easy matter, by a comparison of the map and of the lists, to see how far each species contributes to the districts recognized.

OKHOTSK SEA TO GULF OF GEORGIA.

Strongylocentrotus Dröbachiensis A. AGASS. Okhotsk Sea; Gulf of Georgia.
Strongylocentrotus intermedius A. AGASS. Seghalion.
Echinarachnius excentricus VAL. Kamtchatka; San Diego.
Echinarachnius parma GRAY. Kamtchatka; Aleutian Islands.

GULF OF GEORGIA TO SOUTHERN PERU.

Cidaris **Thouarsii** VAL. Peru; Cape St. Lucas.
Diadema **mexicanum** A. AGASS. Panama; Cape St. Lucas.
Astropyga pulvinata AGASS. Panama; Gulf of California.
Centrostephanus coronatus A. AGASS. Cape St. Lucas.
Arbacia nigra A. AGASS. Peru.
Arbacia spatuligera A. AGASS. Peru.
Arbacia *stellata* GRAY. Peru; Santa Barbara.
Colobocentrotus *atratus* BR. Peru.?
Echinometra **Van Brunti** A. AGASS. Peru; Cape St. Lucas.
Strongylocentrotus Dröbachiensis A. AGASS. Gulf of Georgia.
Strongylocentrotus franciscanus A. AGASS. San Diego; Gulf of Georgia.
Strongylocentrotus eurythrogrammus A. AGASS. Galapagos.
Strongylocentrotus mexicanus A. AGASS. Panama; Gulf of California.
Strongylocentrotus purpuratus A. AGASS. San Francisco; Gulf of Georgia.
Strongylocentrotus gibbosus A. AGASS. Peru; Galapagos.
Pleurechinus *bothryoides* AGASS. Galapagos.
Toxopneustes semituberculatus AGASS. Panama; Galapagos; Cape St. Lucas.
Toxopneustes *pileolus* AGASS. Panama; Gulf of California.
Hipponoë depressa A. AGASS. Panama; Gulf of California.
Amblypneustes **formosus** VAL. Galapagos.?
Echinanthus **testudinarius** GRAY. Gulf of California.
Clypeaster rotundus A. AGASS. Panama; San Diego.
Echinarachnius excentricus VAL. San Diego; Gulf of Georgia.

Echinarachnius parma GRAY. Gulf of Georgia.
Mellita **longifissa** MICH. Peru; Gulf of California.
Mellita **pacifica** VERRILL. Peru; Panama.
Mellita Stokesii A. AGASS. Peru; Panama; Galapagos.
Encope **micropora** AGASS. Panama; Cape St. Lucas; Galapagos.
Encope grandis AGASS. Panama; Gulf of California.
Encope **californica** VERRILL. Gulf of California.
Rhynchopygus pacificus A. AGASS. Panama; Cape St. Lucas.
Lovenia **cordiformis** LÜTK. Peru; Cape St. Lucas.
Agassizia scrobiculata VAL. Peru; Cape St. Lucas.
Brissus **obesus** VERRILL. Panama; Gulf of California.
Meoma grandis GRAY. Acapulco; Gulf of California.
Metalia maculosa A. AGASS. Panama; Gulf of California.
Moira *clotho* A. AGASS. Gulf of California.

NORTHERN CHILI TO RIO LA PLATA.

Goniocidaris canaliculata A. AGASS. Falkland Islands; Straits of Magellan.
Arbacia nigra A. AGASS. Cape Horn; Chili.
Arbacia spatuligera A. AGASS. Chili.
Arbacia *Dufresnii* GRAY. Patagonia; Chili.
Colobocentrotus *atratus* BR. Chili.
Strongylocentrotus albus A. AGASS. Straits of Magellan; Chili.
Strongylocentrotus gibbosus A. AGASS. Straits of Magellan; Chili.
Echinus **margaritaceus** LAMK. Straits of Magellan; Chili.
Echinus **magellanicus** PHIL. Straits of Magellan; Chili.
Hemiaster australis A. AGASS. East Coast of Patagonia.
Hemiaster cavernosus A. AGASS. Patagonia; Chili.
Tripylus excavatus PHIL. Patagonia; Chili.
Schizaster Philippii A. AGASS. La Plata; Chili.

SOUTHERN BRAZIL TO EASTERN VIRGINIA.

Cidaris tribuloides BL. South Carolina; West Indies; Rio Janeiro.
Dorocidaris *papillata* A. AGASS. Florida Gulf Stream; Guadeloupe.
Salenia varispina A. AGASS Florida Gulf Stream.
Diadema setosum GRAY. South Florida; Surinam; Bermudas; West Indies.
Asthenosoma hystrix A. AGASS. Florida Gulf Stream.
Arbacia *punctulata* GRAY. North Carolina; Florida Gulf Stream.
Arbacia *pustulosa* GRAY. St. Thomas; Rio Janeiro.
Coelopleurus **floridanus** A. AGASS. Florida Gulf Stream.
Podocidaris sculpta A. AGASS. Florida Gulf Stream.
Echinometra subangularis DESML. South Carolina; Bermudas; Rio Janeiro; West Indies.
Echinometra **viridis** A. AGASS. Florida Gulf Stream; Hayti; West Indies.
Strongylocentrotus Drôbachiensis A. AGASS. South Carolina.
Strongylocentrotus *lividus* BR. Bahia; Rio Janeiro.
Temnechinus maculatus A. AGASS. Florida Gulf Stream.
Trigonocidaris albida A. AGASS. Florida Gulf Stream.
Hemipedina cubensis A. AGASS. Florida Gulf Stream.
Echinus **gracilis** A. AGASS. Florida Keys; St Thomas; West Indies.
Echinus **norvegicus** DÜB. O. KOR. Florida Gulf Stream.
Toxopneustes variegatus A. AGASS. North Carolina; Bermudas; West Indies.
Hipponoë esculenta A. AGASS. South Florida; Bermudas; Surinam; West Indies.
Echinocyamus pusillus GRAY. Florida Gulf Stream.
Echinanthus rosaceus GRAY. South Carolina; Hayti.
Clypeaster subdepressus AGASS. South Carolina; Brazil.
Mellita testudinata KLEIN. East Virginia; Rio Janeiro; West Indies.

Mellita sexforis A. AGASS. South Carolina; Bermudas; Mexico; West Indies.
Encope emarginata AGASS. South Carolina; West Indies; Rio Janeiro.
Encope **Michelini** AGASS. Alabama; West Florida; Honduras; Yucatan.
Echinonēus semilunaris LAME. Bermudas; Florida Keys; West Indies.
Echinolampas **depressa** GRAY. Florida Gulf Stream.
Neolampas rostellata A. AGASS. Florida Gulf Stream.
Rhynchopygus caribaearum LÜTK. Florida Gulf Stream; West Indies.
Pourtalesia miranda A. AGASS. Florida Gulf Stream.
Homolampas *fragilis* A. AGASS. Florida Gulf Stream.
Echinocardium flavescens A. AGASS. South Carolina; Bahia.
Echinocardium cordatum GRAY. North Carolina; Florida; Bahia.
Echinocardium **pennatifidum** NORM. Florida Gulf Stream.
Agassizia **excentrica** A. AGASS. Florida Gulf Stream.
Brissopsis lyrifera AGASS. Florida Gulf Stream.
Brissus unicolor KL. South Florida; West Indies; Bermudas.
Meoma ventricosa LÜTK. Florida; West Indies; Honduras.
Metalia pectoralis A. AGASS. West Florida; West Indies; Bahia.
Schizaster fragilis AGASS. Florida Gulf Stream.
Moira *atropos* A. AGASS. North Carolina; Florida; West Indies; Texas.

NEW JERSEY TO ICELAND.

Arbacia *punctulata* GRAY. Cape Cod; Long Island Sound.
Strongylocentrotus Dröbachiensis A. AGASS. Iceland; New Jersey.
Toxopneustes variegatus A. AGASS. New Jersey.
Echinus esculentus LIN. Iceland.
Echinocyamus pusillus GRAY. Iceland.
Echinarachnius parma GRAY. Labrador; New Jersey.
Mellita testudinata KLEIN. New Jersey.
Brissopsis lyrifera AGASS. Greenland.
Schizaster fragilis AGASS. Gulf of St. Lawrence.

NORTHERN SHORES OF SIBERIA TO WEST COAST OF FRANCE.

Dorocidaris *papillata* A. AGASS. South Ireland; West Coast of Norway.
Porocidaris **purpurata** THOMS. Shetland Islands; Faroe Islands
Asthenosoma hystrix A. AGASS. Shetland Islands.
Arbacia *pustulosa* GRAY. West Coast of France.
Strongylocentrotus Dröbachiensis A. AGASS. British Seas; Spitzbergen; North Coast of Siberia.
Strongylocentrotus *lividus* BR. West Coast of France; British Seas.
Sphaerechinus granularis A. AGASS. West Coast of France.
Echinus **miliaris** MÜLL. English Channel; West Coast of Norway.
Echinus esculentus LIN. English Channel; West Coast of Norway.
Echinus **acutus** BLAINV. West Coast of France; Irish Sea; West Coast of Norway.
Echinus **norvegicus** DÜB. O. KOR. British Seas; West Coast of Norway.
Echinus elegans DÜB. O. KOR. South of Ireland; West Coast of Norway.
Echinocyamus pusillus GRAY. British Seas; West Coast of Norway.
Pourtalesia miranda A. AGASS. Shetland and Faroe Islands.
Spatangus purpureus LESKE. West Coast of France; West Coast of Norway.
Spatangus **Raschi** LOVÉN. Shetland and Faroe Islands; West Coast of Norway.
Echinocardium cordatum GRAY. English Channel; West Coast of Norway.
Echinocardium flavescens A. AGASS. English Channel; West Coast of Norway.
Echinocardium **pennatifidum** NORM. Shetland Islands.
Brissopsis lyrifera AGASS. South of Ireland; West Coast of Norway.
Schizaster fragilis AGASS. Shetland and Faroe Islands; West Coast of Norway.

PORTUGAL TO WEST COAST OF TROPICAL AFRICA.

Cidaris tribuloides BL. Cape Verde Islands; Liberia.
Dorocidaris *papillata* A. AGASS. Adriatic; Mediterranean.
Diadema setosum GRAY. Cape Verde Islands; Canary Islands; Sicily.
Centrostephanus *longispinus* PET. Madeira; Sicily.
Asthenosoma hystrix A. AGASS. Portugal.
Arbacia *pustulosa* GRAY. Madeira; Azores; Siberia.
Echinometra subangularis DESML. Cape Verde Islands; Azores; Senegal.
Strongylocentrotus *lividus* BR. Canary Islands; Azores; Sicily.
Sphaerechinus granularis A. AGASS. Cape Verde Islands; Azores; Sicily.
Temnechinus maculatus A. AGASS. Josephine Bank.
Trigonocidaris albida A. AGASS. Josephine Bank.
Echinus **microtuberculatus** BL. Cape Verde Islands; Sicily.
Echinus **melo** LAM. Cape Verde Islands; Sicily.
Echinus **acutus** BL. Portugal; Sicily.
Echinus elegans DÜB. O. KOR. Cape Sagras.
Clypeaster subdepressus AGASS. West Coast Tropical Africa.
Echinocyamus pusillus GRAY. Madeira Islands; Azores; Sicily.
Rotula Rumphii KL. Cape Verde Islands; Senegal.
Rotula Augusti KL. West Africa; Liberia.
Echinolampas **Hellei** VAL. Liberia; Senegal.
Homolampas *fragilis* A. AGASS. Josephine Bank.
Spatangus purpureus LESKE. Mediterranean; Adriatic.
Spatangus **Raschi** LOVÉN. Azores.
Echinocardium mediterraneum GRAY. Mediterranean; Sicily.
Echinocardium cordatum GRAY. Mediterranean.
Metalia africana A. AGASS. West Coast Tropical Africa.
Brissus unicolor KL. Cape Verde Islands; Sicily.
Brissopsis lyrifera AGASS. Mediterranean; Sicily.
Schizaster canaliferus AGASS. Mediterranean; Sicily.

CAPE OF GOOD HOPE TO ARABIAN GULF.

Cidaris metularia BL. Red Sea; Mauritius; Madagascar; Mozambique.
Phyllacanthus baculosa A. AGASS. Red Sea; Mozambique; Mauritius; Cape of Good Hope.
Phyllacanthus *imperialis* BR. Mauritius.
Phyllacanthus dubia BR. Zanzibar; Cape Town.
Phyllacanthus verticillata A. AGASS. Mozambique.
Goniocidaris canaliculata A. AGASS. Zanzibar; Natal.
Coelopleurus Maillardi A. AGASS. Mauritius.
Diadema setosum GRAY. Arabian Gulf; Red Sea; Cape of Good Hope; Mauritius.
Echinothrix *Desorii* PET. Red Sea; Zanzibar; Cape of Good Hope; Mauritius.
Echinothrix *turcarum* PET. Red Sea; Zanzibar; Madagascar.
Echinothrix calamaris A. AGASS. Mauritius.
Astropyga *radiata* GRAY. Mauritius; Mozambique.
Heterocentrotus *mammillatus* BR. Red Sea; Seychelles; Mauritius.
Heterocentrotus *trigonarius* BR. Red Sea; Seychelles, Mauritius.
Colobocentrotus *atratus* BR. Seychelles; Mauritius; Zanzibar.
Echinometra lucunter BL. Arabian Gulf; Red Sea; Zanzibar; Madagascar; Natal.
Echinometra oblonga BL. Mozambique.
Parasalenia gratiosa A. AGASS. Zanzibar.
Stomopneustes *variolaris* AGASS. Bourbon; Zanzibar; Natal.
Sphaerechinus **Australiae** A. AGASS. Mauritius.
Pseudoboletia indiana A. AGASS. Bourbon; Mauritius.
Echinostrephus molare A. AGASS. Bourbon; Zanzibar; Natal.
Temnopleureus *toreumaticus* AGASS. Persian Gulf.

Microcyphus **maculatus** AGASS. Muscat; Madagascar.
Salmacis bicolor AGASS. Red Sea; Zanzibar; Mauritius.
Salmacis **sulcata** AGASS. Red Sea; Mozambique.
Echinus angulosus A. AGASS. Bourbon; Mozambique; Cape Town.
Toxopneustes *pileolus* AGASS. Bourbon; Seychelles.
Toxopneustes maculatus A. AGASS. Persian Gulf; Mauritius.
Hipponoë variegata A. AGASS. Red Sea; Mauritius; Mozambique.
Amblypneustes **pentagonus** A. AGASS. Mauritius. ?
Fibularia **volva** AGASS. Red Sea.
Clypeaster scutiformis LAMK. Persian Gulf; Mauritius; Zanzibar.
Clypeaster humilis A. AGASS. Red Sea.
Laganum **depressum** LESS. Persian Gulf; Zanzibar; Mauritius; Madagascar.
Peronella rostrata A. AGASS. Zanzibar.
Echinarachnius parma GRAY. Red Sea.
Mellita **erythraea** GRAY. Red Sea. ?
Echinodiscus **auritus** LESKE. Red Sea; Mauritius; Mozambique.
Echinodiscus biforis A. AGASS. Madagascar; Mussel Bay.
Echinodiscus laevis A. AGASS. Red Sea; Mozambique; Mussel Bay.
Echinonëus **cyclostomus** LESKE. Mauritius; Zanzibar; Mozambique.
Echinolampas *oviformis* GRAY. Red Sea; Mauritius; Cape of Good Hope.
Echinobrissus recens D'ORBIG. Madagascar.
Maretia *planulata* GRAY. Bourbon.
Echinocardium **australe** GRAY. Zanzibar; Cape of Good Hope.
Lovenia elongata GRAY. Red Sea; Zanzibar.
Brissus carinatus GRAY. Mauritius; Mozambique.
Metalia *sternalis* GRAY. Red Sea; Zanzibar.
Metalia maculosa A. AGASS. Mauritius.
Schizaster **gibberulus** AGASS. Red Sea.
Moira *stygia* A. AGASS. Red Sea; Zanzibar.

INDIAN OCEAN TO PHILIPPINE ISLANDS.

Cidaris metularia BL. Indian Ocean.
Phyllacanthus verticillata A. AGASS. Flores; Mindoro.
Phyllacanthus annulifera A. AGASS. Philippine Islands.
Phyllacanthus baculosa A. AGASS. Flores; Amboyna.
Phyllacanthus *imperialis* BR. Ceylon; Aru Islands.
Goniocidaris tubaria LÜTK. Indian Ocean; East Indian Islands.
Diadema setosum GRAY. Bombay; Amboyna.
Echinothrix calamaris A. AGASS. Timor; Amboyna.
Echinothrix *turcarum* PET. Timor; Amboyna.
Astropyga *radiata* GRAY. Borneo; Philippine Islands.
Arbacia nigra A. AGASS. (?) Philippine Islands.
Echinometra lucunter BL. Calcutta; Philippine Islands.
Echinometra oblonga BL. Nikobar; Philippine Islands.
Parasalenia gratiosa A. AGASS. New Guinea.
Heterocentrotus *mammillatus* BR. Indian Ocean; Siam; Philippine Islands.
Heterocentrotus *trigonarius* BR. Java.
Colobocentrotus *atratus* BR. Java; Moluccas.
Stomopneustes *variolaris* AGASS. Java; Calcutta.
Strongylocentrotus albus A. AGASS. (?) Philippine Islands.
Echinostrephus molare A. AGASS. Amboyna.
Pseudoboletia indiana A. AGASS. Philippine Islands.
Temnopleurus *toreumaticus* AGASS. Bombay; Philippine Islands.
Temnopleurus **Reynaudi** AGASS. Birmah; Philippine Islands.
Microcyphus **maculatus** AGASS. Moluccas; Philippine Islands.

Salmacis **sulcata** AGASS. Ceylon; Indian Ocean; Philippine Islands.
Salmacis **rarispina** AGASS. Tranquebar; Philippine Islands.
Salmacis bicolor AGASS. Bombay.
Salmacis **Dussumieri** AGASS. Siam; Philippine Islands.
Mespilia *globulus* AGASS. Philippine Islands.
Echinus angulosus A. AGASS. Nikobar and Philippine Islands.
Hipponoë variegata A. AGASS. Bombay; Philippine Islands.
Toxopneustes *pileolus* AGASS. Timor; Philippine Islands.
Fibularia *ovulum* LAMK. East Indian Islands.
Fibularia **volva** AGASS. Philippine Islands.
Clypeaster scutiformis LAMK. Flores; Philippine Islands.
Clypeaster humilis A. AGASS. Ceylon; Philippine Islands.
Laganum **depresum** LESS. Buru; Philippine Islands.
Laganum Bonani KL. Java; Philippine Islands.
Peronella decagonalis A. AGASS. Bengal; Philippine Islands.
Arachnoides placenta AGASS. Singapore; Philippine Islands.
Echinarachnius parma GRAY. Indian Ocean. ?
Echinodiscus **auritus** LESKE. Amboyna; Philippine Islands.
Echinodiscus laevis A. AGASS. Malacca.
Echinodiscus biforis A. AGASS. Java.
Echinonëus **cyclostomus** LESKE. Flores; Philippine Islands.
Echinolampas *oviformis* GRAY. Tranquebar; Moluccas.
Anochanus sinensis GRUBE. East Indian Islands.
Nucleolites **epigonus** MART. Timor.
Maretia *planulata* GRAY. Siam; Philippine Islands.
Lovenia elongata GRAY. Philippine Islands.
Lovenia subcarinata GRAY. Philippine Islands.
Echinocardium **australe** GRAY. East India Islands.
Brissopsis luzonica A. AGASS. Siam; Banca Straits.
Paleostoma *mirabilis* LOVÉN. Singapore.
Faorina chinensis GRAY. East Indian Islands.
Brissus carinatus GRAY. East Indian Islands; Philippine Islands.
Metalia *sternalis* GRAY. Siam; Philippine Islands.
Metalia maculosa A. AGASS. Timor; Philippine Islands.
Schizaster **ventricosus** GRAY. Siam; Philippine Islands.

SOUTHERN CHINA TO NORTHERN JAPAN.

Asthenosoma varium GRUBE. China.
Diadema setosum GRAY. Ousima; Hong Kong.
Echinometra lucunter BL. Japan.
Strongylocentrotus *tuberculatus* BR. China, Yedo.
Strongylocentrotus nudus A. AGASS. Niphon.
Strongylocentrotus depressus A. AGASS. Niphon.
Strongylocentrotus intermedius A. AGASS. Ousima; Hakodadi.
Sphaerechinus pulcherrimus A. AGASS. China; Hakodadi.
Temnopleurus Hardwickii A. AGASS. Nagasaki; Yedo; Hakodadi.
Temnopleurus **Reynaudi** AGASS. China; North China.
Temnopleurus *toreumaticus* AGASS. China; North China.
Salmacis **sulcata** AGASS. China.
Salmacis **Dussumieri** AGASS. China.
Salmacis **rarispina** AGASS. Shanghae.
Microcyphus **maculatus** AGASS. Ousima.
Microcyphus **zigzag** AGASS. Kagosima.
Mespilia *globulus* AGASS. China; Ousima.
Hipponoë variegata A. AGASS. Ousima.

Toxopneustes *pileolus* AGASS. Formosa; Japan.
Phymosoma crenulare A. AGASS. Hakodadi.
Fibularia **australis** DESML. Ousima.
Fibularia **volva** AGASS. Formosa.
Clypeaster scutiformis LAMK. Formosa.
Echinanthus **testudinarius** GRAY. Japan; Hakodadi.
Laganum **Putnami** BARN. Formosa; Ousima.
Laganum **depressum** LESS. Hong Kong.
Peronella decagonalis A. AGASS. Hong Kong; Japan.
Echinodiscus laevis A. AGASS. China; Ousima.
Astriclypeus Manni VERRILL. China; Yedo.
Echinarachnius mirabilis A. AGASS. Yedo; Hakodadi.
Spatangus **Lütkeni** A. AGASS. Formosa; Hakodadi.
Lovenia subcarinata GRAY. China; Hakodadi.
Maretia *planulata* GRAY. China.
Maretia **alta** A. AGASS. Kagosima.
Echinocardium **australe** GRAY. China; Japan.
Brissopsis luzonica A. AGASS. Formosa.
Faorina chinensis GRAY. Hong Kong; China; Shanghae.
Paleostoma *mirabilis* LOVÉN. Kong Kong.
Schizaster **ventricosus** GRAY. Hong Kong.

PACIFIC OCEAN.

Cidaris metularia BL. Solomon and Sandwich Islands
Phyllacanthus dubia BR. Bonin Islands; New Caledonia.
Phyllacanthus *imperialis* BR. Tonga.
Phyllacanthus annulifera A. AGASS. South Sea.
Phyllacanthus verticillata A. AGASS. Navigator and Sandwich Islands.
Phyllacanthus gigantea A. AGASS. Sandwich Islands.
Goniocidaris canaliculata A. AGASS. Caroline and Sandwich Islands.
Diadema setosum GRAY. Feejee and Sandwich Islands.
Echinothrix *turcarum* PET. Bonin, Navigator, and Sandwich Islands.
Echinothrix calamaris A. AGASS. Society Islands.
Echinothrix *Desorii* PET. Feejee Islands.
Centrostephanus Rodgersii A. AGASS. New Caledonia.
Heterocentrotus *mammillatus* BR. Feejee Islands; Sandwich Islands.
Heterocentrotus *trigonarius* BR. New Caledonia; Sandwich Islands.
Colobocentrotus *atratus* BR. Sandwich Islands.
Colobocentrotus Mertensii BR. Bonin Islands.
Echinometra lucunter BL. New Caledonia; Loo Choo and Sandwich Islands.
Echinometra oblonga BL. Solomon and Sandwich Islands.
Parasalenia gratiosa A. AGASS. Bonin Islands; New Caledonia; Sandwich Islands.
Stomopneustes *variolaris* AGASS. Navigator Islands.
Strongylocentrotus *tuberculatus* BR. South Sea.
Strongylocentrotus gibbosus A. AGASS. Feejee Islands.
Strongylocentrotus nudus A. AGASS. Sandwich Islands.
Sphaerechinus **Australiae** A. AGASS. South Sea; Feejee Islands.
Pseudoboletia granulata A. AGASS. Sandwich Islands.
Echinostrephus molare A. AGASS. Kingsmills, Society, and Sandwich Islands.
Temnopleurus *toreumaticus* AGASS. New Caledonia.
Microcyphus **maculatus** AGASS. South Pacific; Navigator Islands.
Mespilia *globulus* AGASS. Navigator Islands; Tonga.
Evechinus *chloroticus* VERRILL. Christmas Islands.
Hipponoë variegata A. AGASS. Pelew Islands; Feejee Islands; Sandwich Islands.
Toxopneustes *pileolus* AGASS. Navigator Islands; Feejee Islands.

Toxopneustes maculatus A. AGASS. Feejee Islands; Christmas Island.
Amblypneustes pallidus VAL. Feejee Islands.
Fibularia **australis** DESML. South Sea; Sandwich Islands.
Fibularia **volva** AGASS. Kingsmills Islands.
Clypeaster scutiformis LAMK. Kingsmills and Sandwich Islands.
Clypeaster humilis A. AGASS. New Caledonia.
Echinanthus **testudinarius** GRAY. Sandwich Islands.
Laganum **depressum** LESS. South Pacific; Feejee and Sandwich Islands.
Laganum Bonani KL. Pelew Islands.
Peronella decagonalis A. AGASS. New Caledonia.
Arachnoides placenta AGASS. South Sea; Solomon Islands.
Echinodiscus laevis A. AGASS. New Caledonia.
Echinonëus **cyclostomus** LESKE. Navigator and Sandwich Islands.
Nucleolites **epigonus** MART. Lord Hood's Island.
Maretia *planulata* GRAY. Kingsmills; New Caledonia.
Lovenia subcarinata GRAY. Sandwich Islands.
Faorina chinensis GRAY. Sandwich Islands.
Brissus carinatus GRAY. Pelew, Feejee, and Sandwich Islands.
Metalia maculosa A. AGASS. Kingsmills, Society, and Sandwich Islands.
Brissopsis luzonica A. AGASS. New Caledonia.
Metalia *sternalis* GLAY. South Sea; New Caledonia; Navigator and Sandwich Islands.
Schizaster **ventricosus** GRAY. Pelew and Feejee Islands.

WEST, SOUTH, EAST, AND NORTHEAST AUSTRALIA TO NEW ZEALAND.

Phyllacanthus verticillata A. AGASS. South Sea.
Phyllacanthus annulifera A. AGASS. South Sea.
Phyllacanthus dubia BR. Australia.
Phyllacanthus *imperialis* BR. Australia.
Goniocidaris *geranioides* AGASS. Murray River; West Australia.
Goniocidaris tubaria LÜTK. Bass Straits; Tasmania.
Stephanocidaris bispinosa A. AGASS. Australia.
Centrostephanus Rodgersii A. AGASS. Sidney; Houtman's Abrolhos.
Echinometra lucunter BL. North Australia; Houtman's Abrolhos.
Strongylocentrotus *tuberculatus* BR. Sidney.
Strongylocentrotus **armiger** A. AGASS. Australia.
Strongylocentrotus eurythrogrammus A. AGASS. North Australia; New Zealand; Sidney; Murray Riv.
Sphaerechinus **Australiae** A. AGASS. New Zealand; East Australia; Adelaide.
Microcyphus **maculatus** AGASS. Tasmania; W. Australia.
Microcyphus **zigzag** AGASS. Australia.
Salmacis **rarispina** AGASS. Cape York.
Salmacis **sulcata** AGASS. Port Mackay.
Salmacis **globator** AGASS. Australia.
Holopneustes **porosissimus** AGASS. Australia.
Holopneustes inflatus A. AGASS. East Australia; New Zealand.
Holopneustes purpurescens A. AGASS. Australia; Tasmania; Murray Riv.
Amblypneustes *griseus* AGASS. New Zealand; Sidney; Adelaide.
Amblypneustes ovum AGASS. Sidney; Port Lincoln.
Amblypneustes pallidus AGASS. Port Philip; Adelaide.
Amblypneustes **formosus** VAL. Tasmania; Adelaide.
Evechinus *chloroticus* VERRILL. New Zealand.
Echinus **margaritaceus** LAMK. South Sea; New Zealand.
Echinus angulosus A. AGASS. New Zealand; Adelaide.
Fibularia **australis** DESML. Coral Sea.
Fibularia **volva** AGASS. North Australia.
Echinanthus **testudinarius** GRAY. Australia.

Laganum **depressum** Less. Australia.
Laganum **Putnami** Barn. Australia.
Laganum Bonani Kl. Tasmania; Australia.
Peronella *Peronii* Gray. Brisbane Water; Tasmania.
Peronella decagonalis A. Agass. West Australia.
Laganum rostratum A. Agass. New Zealand.
Echinobrissus recens Edw. New Zealand.
Eupatagus Valenciennesii Agass. Port Dalrymple; Tasmania.
Lovenia elongata Gray. Port Dalrymple; West Australia.
Echinocardium **australe** Gray. New Zealand; West Australia.
Breynia Australasiae Gray. South Sea; Sidney; West Australia.
Metalia sternalis Gray. North Australia; Sidney; New Zealand.
Linthia australis A. Agass. Flinders Islands; Tasmania.

GEOGRAPHICAL DISTRIBUTION OF THE GENERA.

THE geographical distribution of the genera, which has formed the basis for the division of the oceans into the four great realms (*Pl. G*) recognized among recent Echini, is given in detail in Plates C, D, E, and F. It has been found impracticable to arrange them on the maps systematically, on account of the color printing and the economy of space. Those genera, therefore, which have a very similar geographical distribution are brought together, or are so limited as not to interfere with the ready understanding of the limits of the other genera represented. It has not been found possible to give always the precise limit of the extension of each genus, but as the exact localities of each species are given with the synonymy, this is not a serious defect, and the range of each genus is sketched out in broad outlines. Genera which have nearly the same range, but differ in some minor points, are represented as identical,—a method, of course, not strictly accurate, but sufficiently so to call up in a broad way the districts to which these genera are limited; as, for example, in *Pl. D* the range of the genera Pseudoboletia, Phyllacanthus, Colobocentrotus, etc., which means simply that the extremes of range are so nearly identical that although the localities from which some of the genera are known to occur are more numerous than others, yet if we intercalate between the extremes, instead of adopting the more accurate method of mapping only what is known, we shall arrive at about the same geographical distribution. In order not to introduce too many colors when the range of a genus is nearly co-extensive with that of two or more genera, the different colors characteristic of the separate genera are given for the genus having the widest range: for instance, in *Pl. D* the range of Echinonëus is made up of its own color in addition to the colors indicating the range of Pseudoboletia, Phyllacanthus, etc.; Salmacis, Echinodiscus, etc., range over a still more limited district, included not only within the limits of the district over which Echinonëus is found, but also within the limits of the range of Pseudoboletia. In the same way in *Pl. C*,

Echinanthus ranges over an area included within the range of Cidaris, Echinometra, etc. And in this same Plate (*C*) the range of Astriclypeus and Faorina, of Arachnoides, Peronella, etc., of Holopneustes, Amblypneustes, etc., is considered sufficiently approximate to be indicated by the same color. In *Pl. E* the range of Hipponoë and Toxopneustes is included within the limits of the range of Brissus, Lovenia in its turn being included within the limits of the range of Hipponoë and Toxopneustes. These examples will suffice to explain the method adopted to show the geographical distribution of genera. Where the localities are in the least doubtful, they have been omitted in the representation of the distribution of the genus on the maps, as in the case of the occurrence of Moira on the Pacific coast of Mexico, and of Mellita and Moira in the Red Sea. Other genera, consisting of but single species of a limited or doubtful range, have also been omitted. They are few, however, and the maps include every genus which is well characterized, the distribution of which can be tolerably accurately ascertained from the range of its species.

PLATE *C*.

AMBLYPNEUSTES,
ARACHNOIDES,
ASTRICLYPEUS,
ASTROPYGA,
CIDARIS,
CLYPEASTER,
COELOPLEURUS,
DIADEMA,
ECHINANTHUS,
ECHINOBRISSUS,
ECHINOLAMPAS,
ECHINOMETRA,
ECHINUS,
EUPATAGUS,
FAORINA,
HOLOPNEUSTES,
LINTHIA,
MESPILIA,
MOIRA,*
NEOLAMPAS,
NUCLEOLITES,
PALEOSTOMA,
PERONELLA,
TRIGONOCIDARIS.

PLATE *D*.

BREYNIA,
CENTROSTEPHANUS,
COLOBOCENTROTUS,
DOROCIDARIS,
ECHINARACHNIUS,
ECHINOCYAMUS,
ECHINODISCUS,
ECHINONËUS,
ECHINOSTREPHUS,
FIBULARIA,
HETEROCENTROTUS,
LAGANUM,
MARETIA,
MICROCYPHUS,
PARASALENIA,
PHYLLACANTHUS,
PSEUDOBOLETIA,
ROTULA,
SALMACIS,
STOMOPNEUSTES,
STRONGYLOCENTROTUS,
TEMNOPLEURUS.

PLATE *E*.

AGASSIZIA,
ASTHENOSOMA,
BRISSUS,
ENCOPE,
GONIOCIDARIS,
HEMIASTER,
HIPPONOË,
HOMOLAMPAS,
LOVENIA,
MELLITA,
MEOMA,
POURTALESIA,
RHYNCHOPYGUS,
TEMNECHINUS,
TOXOPNEUSTES,
TRIPYLUS.

PLATE *F*.

ARBACIA,
BRISSOPSIS,
ECHINOCARDIUM,
SCHIZASTER,
SPATANGUS.

* Spelled on map Moera.

PART II.

ECHINI

OF THE

EASTERN COAST OF THE UNITED STATES,

TOGETHER WITH A REPORT ON THE DEEP SEA ECHINI COLLECTED
IN THE STRAITS OF FLORIDA, BY L. F. DE POURTALÈS,
ASSISTANT UNITED STATES COAST SURVEY,
IN THE YEARS 1867–1869.

BY

ALEXANDER AGASSIZ.

Published by permission of PROF. B. PEIRCE, *Superintendent U. S. Coast Survey.*

WITH FORTY-TWO PLATES.

NOTE.

WITH the permission of Professor Peirce, the Superintendent of the Coast Survey, I have been able to incorporate in my Revision of the Echini the Report on the Deep Sea Echini collected by Count Pourtalès in 1867–1869, while in charge of the expeditions made for the exploration of the Gulf Stream by the United States Coast Survey, in the steamers Corwin and Bibb, Acting Master Robert Platt, U. S. N., commanding. As this Report includes nearly all the species found on the eastern coast of the United States, two of the northern species not actually found by Count Pourtalès have been added to the Report, to make it as far as possible a complete picture of the Echini of the Atlantic coast of the United States. This was the more advisable, as, both these species having been very fully examined in all their earlier stages of growth, they were of essential assistance in the study of the small Echini collected by Mr. Pourtalès.

From the large number of small-sized Echini collected by Mr. Pourtalès it became necessary, in order to study them intelligently, to examine the young of as many species as possible, and obtain some criterion by which to determine this collection accurately. The results to which this examination led me formed the basis of the Preliminary Report, published in the Museum Bulletin, in which was given, as far as it could be done without figures, a short *résumé* of the conclusions to which I have been led by the study of these young, leaving for this Report a detailed description, as well as figures, of the changes there mentioned, which these young undergo. Some of the specimens collected by Mr. Pourtalès are so small that they must have absorbed their Pluteus very recently before their capture. This col-

lection, taken in connection with the Museum materials, gave the means of studying the changes due to growth of the following species: —

Cidaris tribuloides.
Dorocidaris papillata.
Diadema setosum.
Echinothrix turcarum.
Arbacia punctulata.
" pustulosa.
Echinometra Van Brunti.
Strongylocentrotus Dröbachiensis.
Echinus acutus.
" melo.
" norvegicus.
" gracilis.
Sphaerechinus granularis.
Microcyphus zigzag.
Temnopleurus Reynaudi.
Temnechinus maculatus.
Trigonocidaris albida.
Toxopneustes variegatus.
" pileolus.
Hipponoë esculenta.
Echinocyamus pusillus.
Echinanthus rosaceus.
Clypeaster subdepressus.
Echinarachnius parma.
Encope emarginata.
Mellita testudinata.
" sexforis.
" longifissa.
Fibularia volva.
Echinolampas depressa.
Echinocardium cordatum.
Brissus unicolor.
Brissopsis lyrifera.
Agassizia excentrica.

I doubt if, without the aid of the information gained by the study of these young Echini, a satisfactory report of this collection could have been made. The changes some species undergo are so great that nothing would have been more natural than to place the two extremes of the series not only in different species, but often in different genera, and even in different families. As a necessary consequence, the study of these young, showing what we may consider differences due only to growth, will lead to the elimination of numerous species and genera, and give us hereafter a much more accurate basis in our limitation of genera, species, and the higher subdivisions. I shall always consider myself fortunate to have had the opportunity — thanks to the liberality of the Superintendent of the Coast Survey — of examining this collection, forming the most valuable addition to our knowledge of recent Echinoids since the collections of the same order made by Stimpson in the Pacific.

The changes in the classification of the Echini, hinted at in the Preliminary Report, have been carried out as far as the recent Echini are concerned, and I trust that the materials I have succeeded in accumulating will form a more correct standard than we have had heretofore for the determination of the fossil species. The number of fossil genera has been increased to such an

extent, and they have been based upon features which are here shown to have so little value, that before we can make a satisfactory comparison of the fossil species with those now living, a thorough re-examination of the fossil Echini from our present stand-point is absolutely necessary.

In order not to duplicate the descriptions of the Echini of the eastern coast given in this part (Part II.), I shall simply refer to them in their proper place in the descriptive portion of the Revision, Part III. The characters of the families will be fully discussed there; the genera mentioned are, however, described at length, as their limits are frequently so different from those generally accepted that, unless this were done, some confusion would naturally follow. In order to illustrate the species of the Report as fully as practicable, several of the Plates of the descriptive and anatomical parts have been issued with the present Report, as it was found impossible to draw the line distinctly between the plates belonging to the different parts of the Revision of the Echini.

ECHINI

OF THE

EASTERN COAST OF THE UNITED STATES.

DESMOSTICHA.

Suborder **Desmosticha** HAECKEL, Entwickel. Gesch. 1866. (emend.)

CIDARIDAE.

Family **Cidaridae** MÜLL. Bau der Echin. 1854 (emend.)

GONIOCIDARIDAE.

Subfamily **Goniocidarida** HAECKEL, Entwickel. Gesch.

THE subordinal divisions usually adopted since their introduction by Albin Gras do not seem satisfactory, if tested by our present information. In the first place, the whole classification is based upon the separation of the anus from the abactinal system. From what the embryology of Echini has taught us, the position of the anus has not the physiological importance attributed to it by authors who have so generally received this classification. The unstable position it occupies in the same animal at different stages of growth — at one stage opening next to the mouth, then on the margin, and finally opening in the central part of the apical system in the adult — should make us hesitate to adopt a single anatomical feature as our sole guide. In the first place, the order of Perischoechinidae, a most natural one, is founded upon characters derived from the structure of the interambulacral and ambulacral systems. The other two suborders, regular and irregular, usually recognized, can scarcely be called natural. The suborder of regular Echini is more satisfactory than the other, though, from what I have said in the Preliminary Report of the Galerites with teeth, I should be inclined to add them to the suborder of the regular Echini (Desmosticha), as one of its three primary subdivisions, which, as here limited, are the Cidaridae, the Echinidae proper, and the Galerites. The suborder of "irregular" Echini, after the with-

drawal of the Galerites, still contains the Clypeastroids. From the structure of the ambulacral system, they have some affinity with the Spatangoids; yet the presence of partitions and teeth, combined with petaloid ambulacra, seem to constitute good subordinal characters for the Clypeastroids as contrasted with the Spatangoids proper, which include all the edentate forms, taking in also the edentate genera formerly placed among Galerites, as well as the Cassidulidae, sometimes regarded as independent suborders.

CIDARIS.

Cidaris KLEIN, 1734. Nat. Disp. Echin.

Test thick, circular, turban-shaped; actinal and abactinal region equally flattened; ambulacra narrow, undulating, having only granular tubercles arranged in vertical rows rarely more than six; poriferous zones narrow, forming a single vertical row of contiguous, disconnected pores. Interambulacra from three to five times as broad as the ambulacra, with but two vertical rows of primary tubercles; these are few in number, rarely going beyond seven in each vertical row in the largest specimens. They are surrounded by large scrobicular circles, either elliptical or circular. Areola more or less sunken beneath the concave miliary zone; granular tubercles occupy the whole of the coronal plates between the scrobicular circle; the primary tubercles are perforated with a smooth base in all recent specimens.

The abactinal system is large, flat; composed more or less of pentagonal genital plates, nearly uniform in size separated by triangular or crescent-shaped ocular plates. The anal system is pentagonal, with larger plates in angles of pentagon between genital plates.

The primary spines are large, stout, cylindrical, club-shaped, more or less fluted, often surpassing the diameter of the test in length, and the granulations assuming only a longitudinal linear arrangement.

The name **Cidaris** dates back to Klein, but he as well as Leske used Cidaris to denote what corresponds to the Echini regulares. The first limitations were made by Lamarck, and his species of Cidarites correspond to the Cidaridae of Müller and Diadematidae of Peters. The genus has been subsequently modified by Gray, Brandt, Agassiz, Desor, Cotteau, and A. Agassiz. For the sake of convenience, we can separate into two categories the species of Cidaris, those with crenulated base and those with a smooth base.

Cidaris tribuloides

! *Cidarites* **tribuloides** LAMK. 1816. An. s. Vert.
! *Cidaris tribuloides* BL. 1830. Zooph.

Pl. I[d].; Pl. II. f. 1–3; Pl. II[c]. f. 13.

Genital plates somewhat rectangular; ocular large, triangular, with rounded sides; anal system pentagonal; larger plates adjoining genital plates extend little ways towards ocular, so as to separate the genital plates but slightly; whole abactinal system covered with miliary tubercles of nearly uniform size, carrying small, flat, short secondary spines; genital openings placed near outer edge of the plates. Ambulacral zone with one outer row of miliary tubercles separating it from the poriferous zones, and four rows of smaller miliaries,—two well defined, extending between them nearly the whole length of ambulacra, and two exceedingly irregular ones of still smaller tubercles. The two main rows of interambulacral tubercles are separated by a broad median row of miliaries of nearly uniform size, slightly smaller on the median line, the miliaries round the scrobicular circle being but slightly larger. The mamelon is small, with a moderate scrobicular circle. In large specimens there are three small miliary tubercles on each side of the perforated scales of the actinal membrane.

The primary spines are cylindrical, rather slender, sometimes slightly tapering, in younger specimens slightly swollen near the lower extremity; their coloration is light brown, violet tinged, often ringed with white and brown; the granulation is quite close and compact. The secondary spines are broad, flat, yellowish-green, tipped with brown; the ambulacral miliary spines are elongated, of the same color as the secondary ones, while in the interambulacral zone they are gradually reduced to mere papillæ in a large part of the zones.

Lütken has adopted for the common West India species the name of *C.* **metularia** LAM., which he compares carefully with Cidaris tribuloides. It is evident from his descriptions that his C. tribuloides is the *C.* **metularia** LAM.; he says himself that he may not have had the true *C.* **tribuloides** LAM. From a direct comparison of the original specimens of Lamarck of both these species in the Jardin des Plantes, there is no doubt that the *C.* **tribuloides** of Lamarck is the common West India species for which the name of *C.* **annellata** of GRAY had been adopted in the Preliminary Report, supposing Gray to have possessed, as far as could be judged from his descriptions, the common littoral species of the Gulf of Mexico. Gray's originals show that this was a mistake. The locality, however, of his *C.* **annellata**

is not correct; it is undoubtedly a Pacific species. The original of Lamarck's *Cidarites* **metularia** is from the Isle de France, there are also in the Jardin des Plantes specimens from the Red Sea; it has an extensive range, occurs as far as the Sandwich Islands, is quite common in the East Indian Archipelago. The *C.* **metularia** LAM. is also identical with the species which I named **Gymnocidaris minor**, in the Museum Bulletin (1863). Not having, at the time, had the opportunity of examining series of different ages, I find that the differences which had been considered as specific are simply different stages of growth.

In this species of Cidaris, as in genus Cidaris usually, the difference between old and young stages is almost entirely limited to the proportionally larger size of the spines (*Pl. II^c. f. 13*) and the more prominent serrations (recalling Salenia). The abactinal system early assumes the character of the adult; in fact, with the exception of the smaller number of coronal and buccal plates, the above differences in the spines are the only important changes undergone in this genus.

Littoral to 116 fathoms.

(CIDARIS.) DOROCIDARIS.

Dorocidaris A. AGASS. 1869. Bull. M. C. Z., I. et al.

This subgenus differs from **Cidaris** proper by its narrow median ambulacra; in interambulacral area, the smaller number of primary tubercles, with a deep sunken scrobicular area, the scrobicular circle formed by close granulation, leaves the median interambulacral space more or less sunken and bare. The abactinal area is large, does not differ essentially from Cidaris. The spines of this subgenus are long, surpassing the diameter of the test, often twice as long as diameter; fluted, or with pointed granulations arranged in longitudinal ridges or forming disconnected lamellæ. Poriferous zone narrow, undulating with disconnected pores.

Dorocidaris papillata

Cidaris **papillata** LESKE, 1778. KLEIN, Add.
! **Dorocidaris** *papillata* A. AG. 1869. Bull. M. C. Z., I.

Pl. I; Pl. II^c. f. 13–15; Pl. I^b.; Pl. II^a. f. 1–13; Pl. II^b. f. 1–5.

I had, in the Preliminary Report, distinguished the specimens from Florida from Cidaris papillata as **Dorocidaris abyssicola**. An examination of a fine series of Cidaris papillata collected on the west coast of Norway by Dr. Sars, in the Shetland Islands, and in sundry localities extending from Cape Wrath,

to Cape Sagras collected by the Porcupine Expedition, and which I owe to Prof. Wyville Thomson, shows such astonishing variation in the proportions of the coronal plates, the length and thickness of the spines, the position and size of the genital openings, the size of the anal system, of the ocular plates, that the differences I had supposed to be specific between C. papillata and D. abyssicola can only be considered as amounting to individual variations. The difficulty of distinguishing the Mediterranean C. hystrix from the northern C. papillata had already suggested their probable identity, and now that we have the fine series of the Porcupine Expedition, we can hardly hesitate to unite as one species Cidaris papillata, hystrix, abyssicola, and affinis (or Stokesii); the latter being the name given to Mediterranean specimens having comparatively shorter and more distinctly serrated spines than is the case in specimens where the fluting of the spines becomes more prominent, accompanied also by more slender papillæ, features which are repeated in the individual variations of specimens of one and the same locality in the fine series of the Porcupine Expedition collections. It is true that the color given by Philippi and Sars of C. affinis as brilliant vermilion is very different from the color of the Florida specimens, which Mr. Pourtalès informs me are when alive more or less straw color, with a tendency to a dull greenish-brown color, quite well developed in some of the specimens; but as color forms such an unimportant feature in the specific characters of Echini, much stress cannot be laid upon this point.

Median interambulacral space sunken, vertical suture of plates distinctly marked, edged by narrow bare space; three to four concentric rows of secondary tubercles, but slightly smaller than those of the scrobicular circle, extend towards median line from scrobicular circle. Scrobicular area sunken, elliptical. Mamelon small, prominent; mammary boss small, indistinct. Broad zone of secondary and miliaries separating the poriferous zone, the secondary tubercles arranged in irregular radiating rows, separated by slightly marked furrows. In the median ambulacral region the two inner vertical rows of secondary tubercles are near the middle and but little smaller than the external rows. Spines long, fluted, scarcely tapering, often equal in length to twice the diameter of the test. From twelve to eighteen longitudinal furrows on spines, frequently forming lamellæ, or simply ridges with interstitial space fully grown up; collar of spine short, milled ring prominent.

Abactinal system sparsely covered with miliaries in central part of plates, leaving edges bare, well marked by a wavy double line of small tubercles.

Anal system pentagonal, with a more or less pointed plate extending between the genital plates to ocular plates, genital plates rectangular with truncated edges, genital opening large, placed one third diameter of plate from outer edge, ocular plates heart-shaped, ocular opening distinct. Ambulacral papillæ long, slender; interambulacral much curved and stouter.

In younger specimens the sutures are not so prominent, the stellar shape of the anal system not so marked.*

There are considerable differences in the external appearance of specimens collected at different points. A lot of specimens dredged off Carysfort Reef, at a depth of sixty fathoms, at first sight presents such striking contrast to the bulk of the specimens, that it was catalogued as a distinct species. Instead of the long smooth spines, perfectly white, which was characteristic of all the specimens (except quite small ones) thus far collected, they have long slender spines, not so stout in proportion to the diameter of test as when ridges are worn out, with very distinct and prominent longitudinal rows of serrations, but the base of the spine and the milled ring have the same character as the other spines. There is, however, round the abactinal system a circle of younger spines, which are not serrated, but are, on the contrary, somewhat stouter than others, short and smooth, having the same structure as the spines of specimens where all are smooth, or nearly so. The specimens with these slender primary spines also have secondary spines round the primary tubercles of much greater fineness. The coronal plates are more numerous in the specimens with finer serrated spines, but not more so than we find in many of the younger specimens, where the spines are smooth. Had it not been for some specimens collected in forty fathoms near Carysfort Reef, I should have considered these differences of sufficient value to be specific; but several fine specimens possessing half-striated, half-

* The measurements are given in millimetres, the abactinal system is measured from the extremity of the genital plate carrying madreporic body to the outer edge of the opposite ocular plate. The actinal system is measured from the median interambulacral line to the opposite median ambulacral space. The length of the anal system and of the spines when given is always the greatest length. The number of coronal plates given is the number of the interambulacral plates carrying the primary tubercles.

Height.	Diameter.	Abact. Syst.	Actin. Syst.	Spine.	No. of Int. Coronal Plates.
24.5	36.76	19.05	9.04	31. 27.	7 to 6
17.7	27.9	13.8	7.5	51. 50.	6 to 5
18.2	13.9	8.1	2.7	12.5	6 to 5
3.7	9.0	6.3	3.0	11.	6 to 5
2.75	3.6	2.6	1.5	3.75	5 to 4

From forty to two hundred and seventy fathoms.

serrated spines, and specimens possessing thicker smooth spines, fine secondary spines seemed to leave no differences of any value. The abactinal system identical in the two forms. These differences in the spines are probably the result of wear, for the young of both the varieties are identical. In one case the serration becomes worn, stimulating the growth of the spines, as is the case also in Heterocentrotus, where broken or bruised spines frequently exceed in size the spines which have grown normally. As far as I have observed, in the genus Cidaris the spines seem to vary but little in one and the same species, excepting those modifications which are due to the very variable size of the spines upon different parts of the test; but they are all after one pattern; the spines round the actinostome being the only ones which, owing to the constant wear, are liable to be worn out of their regular pattern. Such is at least the case in Cidaris tribuloides, metularia; P. imperialis, baculosa, gigantea; Goniocidaris geranioides, S. bispinosa.

The tubercles are not perforated in small specimens, and it is only long after all the specific characters (*Pl. II^c. f. 8*) are well developed, that the perforation appears, showing that too great value ought not to be attached to this character. The function of this perforation will only be satisfactorily settled from an examination of living specimens.

The mode of growth of the buccal plates of the Cidaridae is totally unlike that of all the other Echinidae, with the exception, probably, of Asthenosoma. These plates perform the part of ambulacral and interambulacral plates, and appear near the test at first, forming in full-grown specimens rows made up of more than two plates, as in the Palaechinidae, suggesting that the test of Palaechinidae must have been made up of plates homologous to the buccal plates of Cidaris. The test, of course, would then have been capable of considerable compression and change of outline, as is the case in Astropyga and Asthenosoma. This similarity is very striking in young Cidaridae, where the number of coronal plates is small, and when the young Sea-urchin seems to consist almost entirely of an abactinal and an actinal system, separated by a narrow band of coronal plates. Let this narrow band of coronal plates disappear entirely, and the buccal plates take a correspondingly great development, and we have a Palaechinus made up of small ambulacral and interambulacral plates consisting of several rows, and continuous from the teeth to the abactinal system, similar to that discovered by Meek and Worthen, the whole test surmounted by short spines, articulating

upon a more or less distinct mamelon. The structural features of the buccal membrane of Cidaridae, of the teeth and of the poriferous zone, appear to entitle them to a higher rank than that of a family, in the suborder of Echinoids, intermediate between the Palaechinidae and Echinidae proper.

SALENIDAE.

Subfamily **Salenidae** AGASS. 1838. Mon. Éch. Salénies. (emend.)

SALENIA.

Salenia GRAY, 1825. Ann. Phil.

Small Echini, remarkable for the extraordinary development of the abactinal system, the connection of one (large subanal plate) of the anal plates with the genital plates, the other anal plates very small, the sutures of the abactinal plates more or less pitted, the madreporic body quite indistinct. Interambulacral areas broad, coronal plates few in number, tubercles in ten principal rows, imperforate, distinctly crenulated, median interambulacral occupied by vertical rows of small secondaries, carrying different kinds of spines (papilliform) from those of the primaries, the abactinal part of ambulacra having similar spines. Primary spines large, of various shapes. Poriferous zones narrow, pores arranged in single vertical pairs. Buccal membrane imbricated, but ambulacra not extending through the buccal plates, as in Cidaridae and some Diadematidae.

The structure of the abactinal system in young Echini explains most unexpectedly the homology of the subanal plate of Salenidae, which has been such a puzzle to Echinologists. In the first place, I must reiterate that the position of the anal system within the abactinal system is not one which can be defined geometrically by any axis we can draw, nor does it hold any organic connection with the general structure of Echini; the madreporic body alone, in Echini proper, giving us the key to the position of an axis which is most intimately connected with the structure of the Sea-urchin. The genital plates are not equally developed: in some genera the ocular plates occupy an intermediate position between genital plates of apparently the same size; but in others the posterior genital plates are somewhat less developed, and the ocular plates are thus placed in direct contact with the anal system,

in which case the anal system appears pushed back posteriorly as in Salenia, owing to the original spiral condition of the Sea-urchin, which continues to affect the growth during the whole time of its existence (see figs. of young Cidaris); the abactinal system sometimes shows very plainly the spiral mode of growth by not being perfectly symmetrical, that is, the plates on the two sides of the longitudinal axis are not equal in size; this is particularly the case in some species of Salenia. The structure of the abactinal system of our living species, Salenia varispina, fully corroborates the view taken of the proper homology of the subanal plate of the Salenidae. The analysis of the abactinal system of a living Salenia here described shows that the subanal plate is the homologue of the first-formed anal plate of young Echini (which in many cases remains decidedly larger even in older stages, Salmacis, Temnechinus, Trigonocidaris), and shows that the abactinal system of Salenia is entirely homologous with the abactinal system of the other Echinoids, the original, first-formed plate only retaining a greater preponderance than has been thus far noticed in other genera. Add now to this eccentric position of the anal system the presence of a large plate covering (as in young Echini) nearly the whole of the anal system, and we have then the remainder of the anal system covered by excessively small plates (as in young Echini), lost, of course, in the fossil Salenidae thus far found. This shows that the subanal plates have no special function, are not special plates found in the group of Salenidae alone, but are simply an embryonic feature retained in the adult, — as is the case in other genera, where, instead of one plate, we may have several (Arbacia, etc.), — so that this subanal plate is simply a part of the plates covering the anal system, and has nothing to do in the apical system with the genital and ocular plates; although from its size it appears (as in young Echini) to be a most prominent feature, and to form part of the genital plates in the abactinal system. This so-called subanal plate is readily recognized as such in Temnechinus (see *Pl. VIII. f. 3*), while even in genera in which the existence of the subanal plate has never been claimed (Temnopleurus, Salmacis), we find that in the oldest specimens of some of the species, this first plate, which at first covered the whole anal system, always retains a marked predominance, and can readily be distinguished from the others, subsequently added to cover the increasing size of the anal system.

The remaining part of the anal system was, in the fossil species, undoubtedly covered by small plates, as in the living species; and that this was the probable structure of the anal system is shown by Wright, who has figured

the abactinal system of Acrocidaris, and removed the genus to Salenidae on account of the presence of a subanal plate. This feature, which seemed so characteristic of a small group of Echini, is one which alone has no primary systematic value, so that we must, I think, hereafter consider the Salenidae simply as a subfamily of Cidaridae, as the description of the species dredged in Florida by Mr. Pourtalès will clearly show.

The mere presence or absence of this so-called subanal plate cannot be of itself sufficient grounds for uniting with the Salenidae such forms as Acrosalenia, any more than the presence of four anal plates in Parasalenia removes it from Echinometradae to place it among the Echinocidaridae. I am inclined to doubt, therefore, the propriety of placing Acrosalenia, as limited by Cotteau, among the Salenidae; and to question the wisdom of removing Goniopygus from it, as it evidently had, like Salenia, the interambulacral granules carrying the second kind of club-shaped spines observed in Salenia, as well as the sutural impressions of the abactinal system which are wanting in true Acrosalenia. Nor do the spines, as far as they are known, warrant such an approximation. The genera of Salenidae have evidently been too much multiplied. The single character of the position of the anus separating Peltastes from Salenia is not, according to analogy, of any generic value; it may be a convenient section of Salenia, but even that is doubtful, to judge merely from the position of the anus, which may be very considerably to one side or the other, as in young Echini; this seems to support the view taken by Forbes, of the identity of Salenia, Peltastes, and, as Cotteau has shown, also of the identity of Salenia and Hyposalenia. When we know something more than we now do of the spines of Salenidae, the identity of these genera may be proved more conclusively. The spines of Goniopygus thus far discovered show an analogy to those of our Salenia; they evidently had small curved spines, but the larger spines were more or less club-shaped and ribbed at the extremity.

Having adopted the view taken by Forbes of the affinity of these genera, borne out by the shifting position of the anus in the anal system of Echinidae, I have no grounds left for separating, as I formerly did, this species as an independent genus from Salenia, with which I therefore now unite it. From what has been said I can see no reason for finding in Salenidae something analogous to the exclusion of the anal system from the abactinal system in the irregular Echini; on the contrary, I am led to consider the conditions there prevalent as eminently embryonic, and to retain, very nearly as it had been done by Agassiz, the limitation of the family and its position as intermediate

between the Cidaridae and the Echinidae, forming a connecting link between them, combining many features of the Cidaridae proper with true features of the Echinidae, and to consider it as a subfamily of the Cidaridae. The absence of the continuation of the ambulacral tubes through the imbricated scales of the actinal membrane is not an objection to placing them among the Cidaridae, as we find in the Diadematidae similar differences (Diadema and Asthenosoma.

Salenia varispina.

! **Salenocidaris varispina** A. AGASS. 1869. Bull. M. C. Z., I.
! *Salenia varispina* A. AGASS. 1872. Rev. Ech., Pt. I.

Pl. III. f. 8–14.

The general appearance of this Salenia (*Pl. III. f. 8*) is that of a young Dorocidaris papillata. The primary spines are enormous, twice the diameter of the test in length, of a brilliant white color, and of all shapes. Some of them are uniformly tapering, others swelling at about one third the distance from the base, others flattened and curved, but all finely longitudinally striated and loosely covered with sharp spines, irregularly arranged along the body of the spines. The secondary spines, as well as the greater number of the spines of the ambulacra, as far as the ambitus, are short, club-shaped, sometimes curved and flattened, longitudinally striated with slight serrations. These short spines give to the median interambulacral (*Pl. III. f. 12*) and ambulacral (*Pl. III. f. 14*) zones the aspect of the corresponding zones of Cidaris; but they are not, as in Cidaris, arranged in a circle round the base of the primary spines. These small spines, as well as the whole abactinal area, are covered with prominent, dark violet pigment cells, standing in striking contrast to the white primary spines. The abactinal system has the structure of that of *Salenia*, but the position of the anal system is that of *Hyposalenia*. The imbricated buccal membrane is covered thickly with plates arranged somewhat as they are in *Echinocidaris;* the ten buccal plates, placed half-way between test and teeth, are sparingly covered by pedicellariæ.* The primary tubercles of the interambulacral area are large, arranged in two vertical rows in the two areas; those of the ambulacral area are smaller (*Pl. III. f. 10*), and diminish rapidly towards the abactinal pole; the median interambulacral space is occupied by two vertical rows of small secondary tubercles. The primary tubercles of both areas are imperforate, but distinctly crenulated. Near the actinostome the ambulacra flare slightly, somewhat as in Hemicidaris. The pores are small, placed in pairs far apart, one

* I could find no pedicellariæ upon the test of the single individual collected.

above the other, so that there seems to be, as far as I could see, but a single pair of pores for each ambulacral plate, though near the mouth they are somewhat closer, differing in this respect totally from the structure of the poriferous zone of any other fossil *Salenia* with which I am acquainted; for in all of them we have a large number of ambulacral plates with the pores closed together. As in *Salenia*, the indentations of the actinostome are very slight (*Pl. III. f. 9*). The abactinal system covers nearly the whole of the abactinal part of the test; the anal system is eccentric (*Pl. III. f. 1.*) There is a marked difference in the size of the genital plates, the three posterior ones being much larger than the two anterior ones; the reverse is the case of the ocular plates. In the largest genital plate there is a trace of the madreporic body, corresponding to the position of the axis assigned to it by Forbes, Müller, and Wright, which cuts the symmetrical axis of the subanal plate at an angle; this is the case also with the angle made by the axis of the madreporic body and the first anal plate of young Echini; the position of the axis passing through the anal plate has no definite relation to the madreporic body. The anal opening is covered by small plates, as in other Echini (*Pl. III. f. 11*). The whole abactinal system is studded with embryonic spines (*Pl. III. f. 13*), which are longest along the exterior edge of the abactinal system, thus separating it most distinctly from the test. The sutures between the plates are sharply cut with deep pits at the angles of junction of the genital and subanal plate, and of the ocular and genital plates. The three larger genital plates have also pits in the middle of their line of junction with the subanal plate. The genital openings are large, placed in the middle of the plates.

Off Double Head Shot Key, 315 fathoms.

ARBACIADAE.

Family **Arbaciadae**, GRAY, 1855. Proc. Zoöl. Soc. London.

ARBACIA.

Arbacia GRAY, 1835. Proc. Zoöl. Soc. London.

Test thick, moderately large, subconical, actinal surface flattened. Ambulacral areas narrow, poriferous zone exceedingly narrow above ambitus, composed of simple vertical pairs, but becomes greatly petaloid owing to flattening of test near actinostome. Tubercles of uniform size, neither perforated nor crenulated, forming two irregular vertical rows in the ambulacral zone, and from four to twelve in the interambulacra, arranged at same time in more or less regular horizontal and vertical rows. Actinostome large, no deep cuts, but very prominent ambulacral lips. Auricles disconnected, teeth like those of Diadematidae and Cidaridae. Anal system composed of four large plates. The bare space of median interambulacral space is due to the resorption of the large tubercles, changed into a coarse granulation which is crowded with pedicellaria along the ambulacral area. Spines stout, long, often spathiform, having a peculiar internal structure partly resembling that of Cidaridae. Buccal membrane bare.

Arbacia punctulata

! *Echinus* **punctulatus** LAMK. 1816. Ann. s. Vert.
! **Arbacia** *punctulata* GRAY, 1835. Proc. Zoöl. Soc. London.

Pl. II. f. 4; Pl. V. f. 1–18.

The species of Arbacia have been too much multiplied, owing to the predominance given to characters which are now known to be either due to differences of age or to very variable features. The character of the abactinal system, the number of coronal plates, with the mode of arrangement of the interambulacral tubercles, as well as the proportions of the actinostome, furnish us with characters by which we can readily distinguish the species enumerated in this Revision. The two species found in the Atlantic are easily distinguished by the great difference in size of the abactinal system, the genital plates forming in A. punctulata a large prominent pentagon; the ocular plates are small and frequently reach the anal system, though usually they are excluded from it; the coronal plates are

high, the tubercles of the interambulacral space distant, separated by crowded miliaries, rarely forming at ambitus more than three rows on each side of the median line, of which usually but one row reaches the apex; though in the specimens from the northern localities we frequently have two and even three of the vertical rows encroaching upon the bare areas reaching well towards the abactinal region. The spines are long, moderately stout, frequently exceeding in length the diameter of the test.

The color, when alive, varies greatly; from a deep violet, almost black, to a straw-color, or spines tipped with violet-brown; dry, denuded tests are usually grayish, with more or less pinkish tint near apex, or light greenish-gray; the poriferous zones being in each case of darker tint than test.

Number of (Interamb.) Primary Tubercles.	Number of Vertical Rows (interamb.).	Diameter of Abactinal System.	Diameter of Actinal System.	Height.	Diameter.	Length of Spine.
16	7	13.4	23.5	29.	47.5	
15	7	12.	22.2	23.5	44.8	36
12	5	8.9	18.	18.7	32.3	29
10	4	7.	11.8	12.	21.	28

Müller was the first to call attention to the difference in the tentacles of the abactinal part of the ambulacral system of this genus. They are pointed, as in Diadema, having no sucking disk, and when fully expanded (as in *Pl. V. f. 1, 2, 3*) give to the Sea-urchin a very striking appearance, forming tufts extending far beyond the spines of that part of the test. These pointed tentacles are flattened in one direction (*Pl. V. f. 6, 7, 8*), they are capable of enormous expansion (*Pl. V. f. 3*), but do not appear to act as rapidly as those provided with suckers, which contract at least contact, while the pointed tentacles can be considerably disturbed before they are drawn in.

The mode of moving of Arbacia is quite different from that of our common Strongylocentrotus; instead of slowly dragging itself along by means of the suckers of the actinal surface, it makes free use of its spines, and by a sort of tilting motion advances quite rapidly. The spathiform shape of the spines around the actinostome in species of this genus is undoubtedly due to the wear and tear produced by this means of locomotion,* which enables them to travel quite rapidly over the ground, though the slower mode of propulsion by means of the sucking tentacles of the actinostome is not unfrequently employed by them when climbing.

* There is formed a sort of cap at the extremity of the actinal spines, found in all the species of Arbacia, which Desmoulins has figured for several species in the Actes de la Soc. Linn. de Bordeaux for 1870, and which is replaced as fast as worn out.

The South Carolina specimens are usually brick-red color in the bare interambulacral spaces with darker sutures, the spines are tipped of same color, but fade gradually towards base into a light-colored violet, or even pale yellow. The tentacles are yellowish-white; the few pedicellariæ found upon test (upper part) are of a dull white color.

In the youngest Arbaciadae observed, we have already four anal plates (*Pl. V. f. 9*). The abactinal system of very young specimens is remarkably prominent, occupying more than one half the abactinal part of the test (*Pl. V. f. 11.*) The whole abactinal part of the test is deeply pitted, Trigonocidaris-like (*Pl. V. f. 11*); the rudimentary tubercles, covering a part of the abactinal part of the test, are connected by ridges (*Pl. V. f. 11*), which are gradually resorbed and reduced to the granulation found upon the coronal plates of this genus. The primary tubercles are at first limited to the ambitus, surmounted by short stout lanceolate spines, Podophora-like (*Pl. V. f. 9*), gradually becoming more slender and proportionally longer with increasing age (*Pl. V. f. 12, 13, 17*), — the opposite of what takes place in Strongylocentrotus, Cidaris, and most young Echini. The rudimentary spines are not seated upon tubercles; they are club-shaped, somewhat similar in shape to those of Podocidaris. The poriferous zone has in the earliest stages the structure found in the adult, only it does not widen at the actinostome (*Pl. V. f. 15*). The ratio of the actinostome to test does not vary greatly in different stages of youth; the edge of the actinal system forming the groove of the gills is turned back but slightly in young, the lips taking the place of cuts becoming more prominent with increasing age. The separation of **Agarites** and **Tetrapygus** to represent the groups with bare or crowded interambulacra is not natural, depending upon the greater or less resorption of the rudimentary tubercles formed in the earlier stages. It is very common to find young of Arbacia punctulata which would pass for young of Tetrapygus, and young Arbacia pustulosa which would pass for young Agarites. Owing to the independent growth of the plates of the poriferous zone, we have either three or four pairs of pores for each ambulacral plate; the same is the case with other Oligoporidae, as limited by Desor, showing that the division he has made, convenient though it is as a key for the easier grouping of genera, is yet not strictly reliable, the mode of growth of many Polyporidae showing in their young stages that they have but a small number of pores for each ambulacral plate, which places them among the Oligoporidae; but, owing to the independent growth of the plates

of the poriferous zone in older stages, they seem to belong to the Polyporidae.

The changes which the tubercles undergo in their growth are very marked; it constantly happens that primary tubercles, in way of formation, become resorbed by the rapid growth of the test; at least, I can account for the variation of the abactinal part of the interambulacral areas in no other way (compare *f. 14, 16, 18, Pl. V.*). Young specimens of such allied species as A. punctulata and A. pustulosa can readily be recognized by the differences of the abactinal system, which is quite pentagonal in young specimens of A. pustulosa (*Pl. V. f. 19, 20*), while the position of the ocular plates relatively to the genital plates presents in this system a totally different appearance from A. punctulata (*Pl. V. f. 14, 18*), where the ocular plates project beyond the line of the genital plates.

The variations which occur at different stages of growth of this species show how difficult it must be to distinguish the various species which have been described at different times, many of which undoubtedly rest upon no more substantial basis than variations due to peculiarities of young stages which have been more or less persistent. The adult (when examining a large series) shows no less liability to variation in the height of the coronal plates, the size of the tubercles, their number upon the sides of the test, and the relative number of the larger and smaller tubercles, as well as the spines they carry; the sculpture even of the plates of the abactinal system, and their shape and size, being subject to considerable variation.

The specimens collected by Mr. Pourtalès seem to show conclusively that the species distinguished as *E.* **Davisii** in the second number of the Museum Bulletin is only a local variety. Allied species of Arbaciadae are difficult to distinguish; and the characters by which *E.* **Davisii** was separated from A. punctulata are found, in the large series of young specimens collected by Mr. Pourtalès at Cape Fear and Florida Keys, to have no permanence. Lütken considers the *Echinus pustulosus* LAM. as a nominal species; quite a number of specimens of it were brought home by the Thayer Expedition from Brazil; the large series we possess proves its identity with A. aequituberculata.

Littoral, — 125 fathoms.

COELOPLEURUS.

Coelopleurus AGASS. 1840. Cat. Syst. Ectyp.

General appearance of Arbacia: narrow poriferous zone, simple pairs of pores above ambitus, tubercles imperforate and not crenulate. Actinostome small, no cuts; tubercles of median interambulacra have a broad bare space entirely covered by minute granulations, forming undulating zigzag lines from one side of the interambulacrum to the other. The tubercles of ambulacra extend to the apex in two more or less irregular vertical rows.

Sutural impressions along median line, at junction of ambulacral plates only on the actinal side, do not extend to the ambitus.

The spines, as far as they are known from the only living species, are extraordinary, far surpassing in length those of the Diadematidae in proportion to the test. They are long, curved triangular spines, tapering very gradually, while on lower surface they resemble those of the other Arbaciadae, and have the same cellular structure so characteristic of Arbaciadae. Outline of test less conical than in Arbacia.

Coelopleurus floridanus

! *Coelopleurus* **sp.** A. AGASS. 1871. Bull. M. C. Z. III. p. 455.
! *Coelopleurus* **floridanus** A. AG. 1869. Rev. Ech. Pt. I.

Pl. II^c. f. 14, 15.

Among the Echini collected by Mr. Pourtalès in 1868–1869, were numerous fragments of spines of Sea-urchins which I was unable, at the time of writing the Preliminary Report, to refer to any genus of Echini known to me. I am able to give some definite account of the spines, having while in Paris had the opportunity—thanks to Professor Bayle—of examining Michelin's collection now in the École des Mines, containing, among other types, a remarkable Sea-urchin of which only a single specimen exists, described by Michelin, in Annéxe A to Maillard's Notes sur l'Isle de Bourbon, in 1863.

This Sea-urchin he named **Keraiaphorus Maillardi**; it was brought up from a depth of two hundred metres on a fishing-line, and was called **Keraiaphorus** on account of its long curved spines, resembling the antennæ of Cerambycidae. The fragments of spines (*Pl. II^c. f. 14*), collected by Mr. Pourtalès off Tennessee Reef, at a depth of one hundred and sixty fathoms, belong to this genus, but differ sufficiently in appearance to show they do not belong to the same species. They are of a bright vermilion on the con-

cave part of the spine, and a light pink on the opposite side; the extremity of the spine is white for a considerable distance; the spine is slightly curved from the base; a section of the spines (*Pl. II^c. f. 15*) shows them to be somewhat triangular, with rounded sides, the long convex side of the triangle being placed on the side of greatest diameter of curvature of the spine, and the short slightly concave or straight sides on the concave part of the spine. The spine is nearly solid, with the exception of a small annular space, nearer the centre than the periphery, made up of one row of large triangular limestone cells, such as are so characteristic of spines of Echini; the central part and the periphery of the spine consist of very minute circular cells, similar to those of Cidaris spines, closely packed together, presenting a homogeneous structure; in consequence, the outside of the spine is not striated, either longitudinally or transversely, and shows simply a homogeneous close granulation, like very fine marble. The longest fragments are about two inches in length, and, to judge from analogy with **Keraiaphorus Maillardi**, they must have attained a length of at least five or six inches. It is to be hoped that future explorations will bring to light this interesting Sea-urchin, as the only specimen thus far found is not in such a state of preservation as to enable us to ascertain its affinities perfectly satisfactorily.

As far as an examination would allow, Keraiaphorus is identical with Coelopleurus, as had already been suggested by Lütken. It has the same abactinal system, the broad ambulacral zones compared with the interambulacral area, though not quite so sunken as in the fossil species. The arrangement of the pores is the same in arcs round the base of the primary tubercles; the genus is closely allied to Arbacia. There are some discrepancies between the description of Michelin and his figures: the tubercles are not perforated nor crenulated, the general structure of the genital and ocular plates is similar to those of Arbacia; unfortunately the anal plates are not preserved, and Michelin says nothing about them. The peculiar structure of the bare portion of the abactinal part of the interambulacra is not sufficiently brought out in Michelin's figures; in the specimen, ridges of small tubercles, running in S-shaped curves across this bare part of the interambulacra from the base of one plate to the angle of the opposite plate, are quite prominent and fully as marked as in the best figures of Coelopleurus given by Cotteau in the Actes de la Société Linnéenne de Bordeaux, *Pl. XII. f. 4, Vol.* XXVII. The spines of Coelopleurus are as yet not known,

unless the spines cited under the name of *Cidaris* **incerta** D'ARCH., in Mém. Soc. Géol. Vol. III. 2d Ser. Mém. 6, p. 420, *Pl. X. f. 11*, found in the same beds as those containing Coelopleurus, should turn out to be the spines of this genus. They greatly resemble the smaller, shorter, and straight spines of Keraiaphorus found round the actinostome, as was suggested to me by Mr. Vaillant of the École des Mines.

Nor is there any mention made of the sutural impressions found between actinostome and ambitus in the median ambulacral space. These impressions were first noticed by Cotteau* in a fossil species (*C.* **Delbosii**) from the lower tertiaries of Gironde; although Michelin has not described them, the accurate pencil of Humbert has not failed to show them in the figure of the test, as seen from the actinal side (in *Pl. XIV. f. 2*, of Michelin's paper).

It is interesting to note in this connection the existence of a fossil species of this genus from the London Clay, described by Forbes in his Brit. Tertiar. Echinoderms, under the name of *Coelopleurus* **Wetherelli**; we have also in the Tertiaries of Alabama and of Bordeaux species of Coelopleurus.

PODOCIDARIS.

Podocidaris A. AGASS. 1869. Bull. M. C. Z., I.

Test regularly arched above, flat below, depressed abactinal surface, surrounded by raised ambulacral ridges; actinal system resembling that of Arbacia; primary tubercles carrying large, spindle-shaped spines, confined to lower surface. Actinal membrane imbricated only towards centre from the buccal plates. Abactinal part of test covered by spines not articulated, rising directly from test; median ambulacral and interambulacral spaces deeply pitted by depressions surrounded by the ridges extending from the base of the rudimentary club-shaped spines. Poriferous zone narrow; a single vertical row of pairs of pores; abactinal system large, resembling that of Arbacia; anal system covered by four large plates.

Podocidaris sculpta

!**Podocidaris sculpta** A. AG. 1869. Bull. M. C. Z.

Pl. IV. f. 8–16.

This species has, at first glance (*Pl. IV. f. 8*), the general facies of a young Arbacia, with a depressed abactinal surface, the ambulacra rising in ridges

* Échinides Nouveaux, Rev. Mag. Zool., August, 1864, p. 105, *Pl. XIV. f. 10.*

above the surface. The large primary spines are confined to the lower surface as in Colobocentrotus, the primary tubercles scarcely extending beyond the ambitus in the largest specimens obtained (*Pl. IV. f. 9, 10*). These tubercles alone carry a large, smooth mamelon, while the rest of the test is covered with rudimentary spines (*Pl. IV. f. 10*), arranged, however, in regular, vertical rows, four of which form a distinct, raised band in the median interambulacral zone, flanked by three more, less well defined, placed in a comparatively lower plane, while in the narrow ambulacral zone there are but two such rows, close to the poriferous zone, which is very narrow, the pores being arranged in a single vertical row, as in Arbacia (*Pl. IV. f. 12*). The rudimentary, knob-shaped spines,* strongly serrate, are not carried upon a mamelon, but rise directly from the test, as in very young Sea-urchins, and are connected at their base by a ridge, leaving thus a more or less quadrangular pit in the space between four tubercles (*Pl. IV. f. 13*). This ridge is particularly prominent between the spines of the median interambulacral rows, while in the more irregular rows the ridges are less marked, forming simply depressions in the test, running irregularly. The pits in the ambulacral zone are very marked, and are connected into an irregular groove extending along the whole ambulacral zone, the ridges, starting from the base of the tubercles, extending only part way across the ambulacral area, like spurs and rounded knobs. The whole surface of the test (*Pl. IV. f. 8*) is covered with long-stemmed, articulated pedicellariæ (*Pl. IV. f. 16*), which have a distinct mamelon for their support (*Pl. IV. f. 13*), surrounded by a sort of scrobicular circle, the base of the pedicellariæ forming a ball-and-socket joint with the tubercle, while there is a thin muscular membrane holding them in place, as in true spines, — an additional proof that pedicellariæ are only modified spines, as was made probable by their identical mode of development with spines, observed in the Starfishes and Spatangoids

* We have in the adult of this genus, occurring with articulated spines such as are found in fully grown Echini, rudimentary spines rising directly from the test, as we find them in very young Echini or in all Starfishes, yet associated with pedicellariæ having an articulation playing upon a distinct tubercle, and surrounded by a scrobicular circle. The probable function of the pedicellariæ of scavengers and providers seems tolerably well proved, not only by my own observations in our common Sea-urchin, but also by those of other writers on the pedicellariæ of other genera, where they have been seen clasping small Crustacea, Annelids, and other minute marine animals. Starting from the simple network of the reticulation of the test, we pass gradually to all the forms of spines, whether fixed or articulated, whether appearing as mere knobs or granules, to the complicated articulated spines of Cidaris on one side, or from the same granules through fixed pedicellariæ to the highly articulated and movable pedicellariæ of this genus. To this I shall recur again when describing the pedicellariæ of Echini in connection with other anatomical points.

by Müller and myself.* The abactinal system, placed in a depression of the abactinal part of the test, resembles that of Arbacia, having only four anal plates (*Pl. IV. f. 14*), with large genital and ocular plates, which, however, are not bare as in that genus, but carry small, rudimentary, knob-shaped spines. The genital openings are near the anal system. The buccal membrane carries ten large quadrangular plates, with rounded edges placed near the test, the whole space between them and the mouth being covered by small plates (*Pl. IV. f. 9*); the rest of the membrane is bare. The actinal opening is large, the cuts slight, and the pores are not arranged in arcs near the mouth, as in Echinocidaris. The spines are sharp, flat, spindle-shaped (*Pl. IV. f. 8*) with a prominent ridge running along the middle of the upper surface; the section is triangular, the longest side being the under side, which is convex, the shorter upper sides being concave, as is shown better in the enlarged section (*Pl. IV. f. 15*). The spines are finely granulated longitudinally, with a slightly serrated edge. The large spines, as well as the knobs of the rudimentary spines, are sometimes beautifully colored by dark violet pigment cells, following the arrangement of the granulation. The pedicellariæ have the same coloration. The tentacles, to judge from alcoholic specimens, must have been very large, though not possessed of a powerful disk; being, especially near abactinal pole, blunt, or more or less pointed (*Pl. IV. f. 8*), as in Arbaciadae; the test, when prepared to show the structure, was of a delicate cream-color, upon which the brilliant coloration of the knob-shaped spines stood out in bold relief.

138 to 315 fathoms.

* This genus may be truly said to represent Temnopleurus among the Arbaciadae. It is closely allied to Glypticus, where the primary tubercles are gradually changed to irregularly shaped ridges, covering the abactinal part of the test. For figures of Glypticus see GOLDFUSS, Pet. Germaniæ; and AGASSIZ, Echinod. foss. Suisses.

DIADEMATIDAE.

Family **Diadematidae** PETERS, 1853. Monatsb. Akad. Berlin. (emend.)

ASTHENOSOMA.

Asthenosoma GRUBE, 1867. Jahresb. d. Schles. Ges. f. Vat. Cul.

Test flexible; ambulacral and interambulacral areas composed of narrow plates, in which calcareous deposits are limited to the median ambulacral and interambulacral spaces, the remainder of the plate being more or less membranous. The calcareous part of the plates is pistol-shaped, the but end turned towards the actinostome in the interambulacral area, and turned in the opposite direction in the ambulacra; they lap slightly along the median line in both areas, and turning in opposite directions, give the test a great degree of mobility. This character of lapping of the plates in opposite directions in the two areas was thus far only known among the Palaechinidae (Melonites, etc.). The tentacles are pointed near abactinal area, as in the Diadematidae. The abactinal system resembles that of other Diadematidae, has a small anal system, and approaches more the structure of that of Centrostephanus. There is in each area a principal vertical row of large perforate tubercles; the rest of the plate is occupied by smaller tubercles, similar in structure, arranged in an irregular horizontal line, — a mode of arrangement thus far not found among the Diadematidae. The poriferous zone is not formed of independent plates, the large ambulacral plates are themselves perforated for one pair of pores, the two other pairs passing through small scales, resembling the ten buccal plates of Echini of the membranous part of the large plate; they form three vertical rows of pores, reminding us somewhat of the arrangement of the pores of Hipponoë; the two inner vertical rows passing through the membranous part of the large plate are placed close together; the other vertical row is well separated, placed nearer the interambulacral zone, their structure recalling remarkably the structure of the poriferous zone of Palaechinidae.

Asthenosoma hystrix

! **Calveria hystrix** W. THOMSON, 1869. Prelim. Rept. Porcup. Exped Proc. R. S.
! *Asthenosoma hystrix* A. AG. 1872. Rev. Ech. Pt. I.

Pl. II^c. f. 1–5.

The probability of the correctness of the view which I took in the Preliminary Report, of referring a small Sea-urchin to Calveria hystrix, is greatly strengthened by finding among some refuse of the dredgings from Florida, collected by Mr. Pourtalès, a couple of plates of Asthenosoma hystrix. They must have belonged to a specimen measuring about one and a half inches in diameter, to judge by a specimen slightly larger, which the Museum owes to the kindness of Professor Thomson, collected by the Porcupine Expedition. The small spines on this specimen show the same structure as those of the young Sea-urchin referred to (Asthenosoma), and figured on *Pl. II^c. f. 3.* Older spines become somewhat trumpet-shaped (*Pl. II^c. f. 4*). The peculiar structure of these spines is well shown in the transverse section (*Pl. II^c. f. 5*), — a structure identical with that of the spines of Asthenosoma varium, which I owe to the kindness of Professor Grube of Breslau. The pedicellariæ also are similar, leaving but little doubt of the generic identity of these two remarkable Sea-urchins.

The young specimen, briefly mentioned in the Preliminary Report, is a small Sea-urchin, about $3^{mm.}$ in diameter (*Pl. II^c. f. 1, 2*). It is already of a size when a young Diadema has its plates tolerably well defined, and when its spines far surpass the diameter of the test in length, besides being provided with a long anal proboscis, which at once characterizes young Diadematidae This specimen was nearly flat, the outline deeply cut at the ambulacra (*Pl. II^c. f. 1*), the interambulacra projecting as large lobes beyond the general outline; the whole test was made up of small limestone cells (*Pl. II^c. f. 2*), and evidently was quite movable, though tough in its present condition; there were deep actinal cuts in the centre of the ambulacral field (*Pl. II^c. f. 1*), the actinal membrane unfortunately was not well preserved. The spines were very short (*Pl. II^c. f. 3*), and bore about the same ratio to the test which they have in Astropyga and Asthenosoma, the tubercles were not yet separated from the general limestone network of the test, and the spines were arranged in the interambulacral spaces in two irregular main rows, and in one row in the ambulacral spaces, both extending to the abactinal pole from the ambitus, the test round the actinostone being bare (*Pl. II^c. f. 1*).

Florida Gulf Stream, 138 fathoms.

DIADEMA.

Diadema Schyn. 1711. Thes. Imag. (Peters. emend.)

Outline of test slightly pentagonal, flattened at both poles, test moderately thin. The tubercles of the ambulacra somewhat smaller than those of the interambulacra, arranged in two vertical rows. The tubercles of both areas are crenulate, perforate. The poriferous zones are narrow, the median ambulacral region much broader than the poriferous zone, but the ambulacra narrow compared to width of interambulacra, and often rising considerably above them. The pores are arranged in simple pairs, forming arcs round the adjacent tubercles. The spines are all of same nature, hollow, closely verticillate, and very long upon both areas, often three and even four times the diameter of test in length. The milled ring at base very large and prominent, and rapidly tapering to the width of shaft, which is maintained to extremity. The actinal system is large; there are ten broad cuts, not very deep, but provided with thin processes diverging from them. The actinal membrane is thin, barely strengthened by small limestone plates. The ambulacral suckers are provided with suckers on lower surface, but above the ambitus, up to the abactinal system, they are pointed as in Arbacia.

The bare part of the sunken interambulacra extending from the genital plates branches and extends on either side of the outer main tubercles. The abactinal system is made up of five large, pointed, triangular genital plates, the genital openings placed in a pit near outer extremity. The ocular plates are small, regularly intercalated between the genital plates. The anal system is covered by a thin naked membrane, only strengthened near genital plates by a row of small plates, anal opening at end of a tube extending like a proboscis three to four times the length of the anal system. Teeth large.

Diadema setosum

! *Diadema setosa* (**Gray**), 1825. An. Phil. p. 4 (non Rumph).

Pl. II^{b}. f. 6–10; Pl. II^{c}. f. 6; Pl. IV^{a}. f. 1; Pl. VI^{a}. f. 5.

I have been unable, after repeated examinations of a large series of specimens from many localities, to distinguish more than two species of Diadema. Bölsche had already called attention to his inability to separate Diadema antillarum from Diadema Savignyi; and I have to acknowledge that the different species I attempted to discriminate from various localities in the

Pacific and Eastern seas cannot be maintained, with the exception of Diadema mexicanum. I add for the sake of comparison the measurements of the only two species of Diadema which seem to me to be based upon permanent characteristic differences.

The height is extremely variable in all species of Diadema, the abactinal system being frequently sunken considerably below the level of the abactinal parts of the ambulacra, which rise like prominent ridges above the depressed median interambulacral space. In the specimens of Diadema mexicanum I have thus far examined this is rarely the case, the abactinal region is but little sunken. The connecting ridges of the auricles are prominent, the auricles themselves triangular, festooned, but less powerful than in the Mexican species.

Diameter Abactinal System.	Diameter Anal System.	Diameter Actinal System.	Diameter of Test.	No. of Primary (interamb.) Tubercles	
23	13.5	40.	90.	17	D. Mexic.
		35.	86.		D. setosum.
13	7.2	32.9	62.	15	D. Mexic.
14	9.	28.	66.	15	D setosum.
13	8.	27.5	51.5	13	D. Mexic.
		22.4	46.0	14	D. setosum.

The spines, as a usual thing, are more slender and the verticillations closer than in the Mexican species; the miliaries small, scattered in irregular, disconnected vertical lines between the primaries, the bare space of median interambulacral row generally extending to the fourth coronal plate from the abactinal pole.

The original specimen of Lamarck of *Diadema turcarum* in the Jardin des Plantes was from Martinique.

Littoral to 17 fathoms.

In the young of both Diadema and Echinothrix the spines are proportionally larger, and being so much less numerous, give to young Diadematidae a peculiar facies, — E. calamaria-like (*Pl. II^c. f. 6*). We find also in young Diadema characters in the actinal membrane differing from the adult; the peculiar grouping, in five separate clusters,* of the buccal ambulacral plates which appear first, is soon lost by the encroachment of the

* In the Preliminary Report, misled by this embryonic character of young Diadematidae, I took it for granted that Echinodiadema of Verrill, in which these plates are covered with short spines, were only an embryonic feature. I have since that time had the opportunity of examining the buccal membrane of Centrostephanus of Trichodiadema, and find that large specimens of these two genera have identical plates, covered by spines, with those of Echinodiadema, and that this character is an excellent one to distinguish Centrostephanus (= Trichodiadema = Echinodiadema) from the true genus Diadema in addition to its other characteristic features.

smaller interambulacral plates, and in older specimens the plates become deeply embedded in the buccal membrane. The pores at first are placed in a vertical row in very young specimens; they then become arranged in arcs of three or four pairs: with increasing age the median rows of interambulacral tubercles assume the arrangement found in the adult. Owing to the rapid growth of the spines in the young, the extremity, and frequently the greater part of the spine almost to the base, is hollow; but as the young increase in age they become more solid at the base, and further up in proportion to their age. The anal tube of small specimens is very striking, being as prominent as the anal proboscis of some species of Comatulae (*Pl. II^c. f. 6*). The anal membrane is still quite flexible in the adult, and forms a proboscis, though shorter proportionally than in the young, as Grube pointed out some time since.

In very young *Echinothrix turcarum* the spines become early solid, and differ generally strikingly, on account of the close verticillation forming a longitudinal striation, from those of Diadema or of the other species of Echinothrix. I was inclined formerly to retain for this species the generic name proposed first by Gray, but having examined a large series of this species in the Godeffroy Museum, I find that although the spines are more closely verticillate, yet the solidity — the main character upon which the generic separation was based — was not so universal as I had been led to suppose, and the structure of the test presenting no feature by which the species of this group could be distinguished generally, they have been united with Echinothrix.

ECHINOMETRADAE.

Family **Echinometradae** GRAY, 1855. Proc. Zoöl. Soc. London, p. 37.

STRONGYLOCENTROTUS.

Strongylocentrotus BRANDT, 1835. Prod. Descript. An.

This genus was first established by Brandt for the typical *Echinus* **chlorocentrotus** = Dröbachiensis. It has, in the subsequent limitations of the genera into which Echinus has been divided by Agassiz, Desor, A. Agassiz, Lütken, Verrill, completely escaped their attention. It includes all species having a somewhat circular or subpentagonal, regularly arched or slightly

depressed test, with smooth, imperforate, not crenulate tubercles of unequal sizes, forming primary and secondary vertical rows. Pores arranged in arcs of at least four to five pairs. Actinostome decagonal; very slight cuts; buccal membrane bare; spines moderately slender, longitudinally striated, longer proportionally than those of true Echinus, and more slender than those of Sphaerechinus.

The analysis of the mode of growth of the pores shows how impossible it is, upon the mere question of quantity or direction of the pores, to subdivide this genus as has frequently been attempted; and now that it is associated with the Echinometradae, instead of the Echinidae, where we find variations similar to those noticed in Strongylocentrotus, the homogeneous nature of the genus as now limited cannot fail to be apparent, and however convenient the former generic sections may be as keys for ready identification of species, we cannot allow them greater value. The modifications of the poriferous zone upon which these so-called generic distinctions have been based are in this case simply quantitative modifications, not involving a single structural feature, as an examination of the analysis of the plates of the poriferous zones of Echini apparently shows; the petaloid appearance of the zones immediately round the actinostome is a mere result of the flattening of the test, and the direction of the arcs of pores due to the greater or less rapid growth of the new additional plates of the poriferous zones or of the primitive plate of each arc. If the latter grows rapidly, the arcs are open and transverse (Loxechinus); if it is the older plates which grow very rapidly, we have very regularly arched arcs, each arc (Toxocidaris) of greater or smaller size if the new plates are added only at the upper part of the arc; while if they are also added at the open end of the arc, the arcs are more vertical (Sphaerechinus), a structural feature which, taken into connection with the actinal cuts, seems to entitle the section (Sphaerechinus) to rank as subgeneric.

Strongylocentrotus Dröbachiensis

! ? *Echinus* **Dröbachiensis** MÜLL. 1776. Zool. Dan. Prod.
! *Strongylocentrotus Dröbachiensis* A. AG 1872. Rev. Ech. Pt. 1.

Pl. IV[a]. *f. 2, 3, 4; Pl. IX; Pl. X.*

After a careful re-examination of the whole subject I am unable to distinguish more than one species of Strongylocentrotus in the circumpolar specimens thus far collected. I am aware that there are marked local differences,

and can readily see how with small series it would be possible to establish the species generally recognized as S. chlorocentrotus, S. granularis (granulatus Gould). Careful measurements of a number of specimens of the alleged species are here given, tabulated according to their origin, and fail to show any characters by which they can be separated.

The thickness of the test is extremely variable, the specimens from the northwest coast generally are very much thinner (chlorocentrotus), though those which are known as carnosus are more like Dröbachiensis, and have a somewhat thicker shell, while in granulatus it is often quite thick. The shape and outline are very variable, as seen from measurements. Coronal plates are of median height, with but one large tubercle on each plate, forming the two principal vertical rows of the interambulacral space, the rest of the plate being closely covered by secondaries, so as to form irregular vertical or transverse lines, as is usually the case in granulatus; or the vertical lines are more regular (as in Dröbachiensis), the secondaries being larger and the smaller secondaries less prominent, these being the greatest extremes. The same general features of arrangement hold good in ambulacral and interambulacral spaces. Though the extremes have been mentioned, we find the loose arrangement of granulatus combined with the thin and thick test, and with the broad and narrow poriferous zone. The arcs of pores of granulatus are straighter, but in Dröbachiensis said to be more vertical. This depends upon the height of the vertical plates; when arcs are straight, the poriferous zones are separated by two irregular oblique rows of minute tubercles which follow the curve of the poriferous zones. The number of pairs of pores varies greatly; in one and the same specimen we find one zone with six pores near ambitus and generally but five above it, when in the next zone there may be five or six above as a general thing.

Of the ocular plates two reach the anal system and the others are excluded. The madreporic body is very much larger than other genital plates, which are short-sided near the anal system, and long, pointed, extending beyond the level of the ocular plates, with pretty large genital openings. Secondaries covering loosely the whole abactinal system; anal system large; exterior row of plates largest, gradually diminishing towards anus. Spines vary greatly in length, comparatively slender, greenish-purple, or violet, or flesh-colored, or even cream-color. Buccal membrane thin, with few small plates irregularly placed in continuation of ambulacral system. Auricles slight, with large opening; shallow ridge connecting them.

Chlorocentrotus.

No. Interamb. Tubercles.	Diam.	Height.	Abactin. System.	Anal. System.	Actinal System.	Width Porif. Zone.	No. Pores.	Spine.
24	82.	32.7	18.5	9.	23.4	6.	6	14.
19	62.5	29.	14.	7.	19.9	4.5	6	13.
18	43.4	22.3	11.9	5.1	15.5	3.2	6	8.9
16	34.	18.2	8.9	4.1	12.	2.9	6	7.2
13	22.9	10.4	5.	2.8	9.3	1.9	6	7.1

Dröbachiensis.

21	60.	33.	13.	7.2	19.	4.6	6	15.
16	48.2	21.4	12.	7.	17.9	3.5	6	12.6
15	44.4	19.	11.	5 6	15.	2.5	6	11.5
14	45.2	23.	11.1	5.8	16.5	3.0	6	
18	50.	21.3	12.4	6.	16.3	2.9	6	
11	20.5	9.	5.8	2.5	19.5	1.8	5	

Granulatus.

24	78.2	38.2	19.	10.3	23.	4.9	6
23	68.	39.5	15.6	6.2	20.	5.0	6
20	58.4	30.	12.5	6.	17.	4.1	6
21	53.	29.3	12.	5.1	17.4	3.9	6
19	52.	26.	11.8	4.1	16 2	4.	6
16	39.	19.1	9.2	5.	14.3	3.	6
14	38.	19.4	7.4	3.9	11.5	2.9	6
12	22.3	10.7	6.1	3.3	10.2	2.	6
10	13.	6.9	4.	2.	6.4	1.1	6

In the young Sea-urchins where the Pluteus has only been resorbed recently (*Pl. X. f. 1*), we find the spines limited to the edge of the flat test, not articulated. They are few in number, and remarkable for their size. There is no trace of an anal system, the anus still opening by the side of the mouth as in young Starfishes. The tentacles equal in length the diameter of the test. The whole test is thickly covered by dark crimson pigment cells. The spines, which are at first mere projections of the calcareous network of the shell, become more fan-shaped in older specimens (*Pl. X. f. 4*) as they extend further towards the abactinal pole. The odd tentacle expands to a remarkable extent, sometimes to three times the radius of the test. The four tentacles of each ambulacral space are short and stout, and capable of but limited expansion and contraction (*Pl. X. f. 3*), the whole actinal membrane being covered by an open plating of limestone cells. The actinal system is circular (*Pl. IX. f. 2*), without any notches, large, with teeth occupying but a small part of the actinal space, extending as five narrow wedges from the centre to edge of test. The tubercles are also comparatively large. These embryonic features are soon lost, pedicillariæ begin to appear, the spines lose their fan shape, becoming

more elongate, though still serrate; the tentacles are more numerous; the anal system is developed as a single large plate (*Pl. X. f. 2*), the anus opening to one side of it; and we commence to trace distinct sutures separating the coronal plates, new plates being added at the abactinal pole round the anal system.

In young specimens of somewhat less than one eighth of an inch in diameter (3$^{mm.}$), having five : six ambulacral plates (*Pl. IX. f. 3*), we find features totally unlike those belonging to the genus Strongylocentrotus. The anal system is closed by one large circular plate occupying the whole of the space between the genital plates. A line passing through the madreporic body and the anal plate does not pass through the symmetrical axis of the plate, but at a considerable angle, showing (as is the case in all young Sea-urchins) that we cannot use the anal plate, or opening of anus, as a guide for the determination of any one axis in Sea-urchins. So that the attempt made to define the longitudinal axis by a line passing through the axis of symmetry of the subanal plate does not give us any fixed position. This attempt was only introduced from taking the subanal plate of Salenia as the guide in fixing this axis, but if the subanal plate of Salenia is only the homologue of the large anal plate of young Echini (*Pl. IX. f. 3, 6, 8*), it is natural to find the madreporic body to one side of it, as we find in the young of several genera of Echini. The symmetrical axis of the anal plate pointing either to the second or third genital plate (counting from the madreporic body to the left), and as I have shown in my Memoirs on the Embryology of Echinoderms that the plane of the madreporic body was one connected with a fundamental point of structure in the plan of the young Echinoderm, there is no anomaly presented by finding in Saleniae the madreporic body passing asymmetrically through the subanal plate, that being, as is the case in all Echini, its natural position.

In these small specimens we find the pores arranged in vertical arcs of four pairs for each ambulacral plate (*Pl. IX. f. 5*). There are two main vertical rows of primary tubercles in the ambulacral and interambulacral zones, nearly of the same size, surrounded by a few secondary tubercles irregularly arranged; the test is quite flat in proportion to the diameter, and, when seen from below, we find the actinostome of extraordinary proportions (*Pl. IX. f. 4*), occupying fully three quarters of the whole lower part; the outline is scarcely indented; the points of the teeth are blunt, triangular; the membrane is naked, being slightly stiffened by small granules round the at-

tachment to the teeth. The ten perforated plates carrying tubercles, which in the adult are close to the base of the teeth, are found to be close to the test. In a somewhat older specimen, measuring 3.5$^{mm.}$ in diameter and having nine : ten plates, there are traces of four additional minute plates in the anal system (*Pl. IX. f. 6*). There is no change in the arrangement of the pores or of the tubercles; when seen from the lower side, the actinal opening occupies a much smaller proportion of the test (*Pl. IX. f. 7*). The tentacular plates are nearer the centre, and the ambulacral and interambulacral spaces on the periphery of the actinostome are equal, the latter having been the larger in the younger stages. In a specimen somewhat older, measuring 5.1$^{mm.}$ in diameter, the notches of the actinostome are more marked, the opening reduced still further in proportion (*Pl. IX. f. 10*); and in specimens of 8.4$^{mm.}$ in diameter the actinal opening has about the proportions of the adult (*Pl. IX. f. 12*), the ambulacral area is broader than the interambulacral at the periphery, the notches are about as they were in the preceding stage. In the specimen measuring 5.1$^{mm.}$ in diameter, we find the first trace of the open arcs of pores towards the ambitus (*Pl. IX. f. 9*), while the upper tubercles are still surrounded by closed vertical arcs (*Pl. IX. f. 8*). It seems impossible to account for the subsequent arrangement of the pores, except on the supposition that the plates forming the poriferous zone grow independently of the ambulacral plates, and that they are pushed along down towards the ambitus, forming open arcs of four or five or even a larger number of pairs of pores.

In all these stages (*Pl. IX. f. 3–12*), the test was quite depressed; it is only when it attains a diameter of 8.4$^{mm.}$, that the depression is not marked, and the young Sea-urchin assumes the general outline and characters of the adult, as is shown by the greater number of plates of the anal system and the regularly open arcs of pores, as well as the appearance of the secondary rows of tubercles.*

* The same general changes take place in S. lividus as in S. Dröbachiensis. In very small specimens, 2.5$^{mm.}$ in diameter, and having four : five coronal plates, we find four pairs of pores for each ambulacral plate arranged in an almost vertical row and but slightly curved. The same is the case in specimens measuring 3.6$^{mm.}$ in diameter, with six : five tubercles when the curve is somewhat more decided. In specimens having seven : eight plates, and measuring 6.3$^{mm.}$ and 8.4$^{mm.}$ in diameter, we find still the same vertical arrangement of the pores. The arcs do not open till the Sea-urchin has attained a diameter of 10$^{mm.}$, when we find in one plate an arc of five pairs of pores, and in specimens measuring 12.7$^{mm.}$, two plates with open arcs of five pairs of pores. Young S. lividus are much more flattened than the young of S. Dröbachiensis, being generally more turban-shaped, while the latter are always very slightly conical. The

ECHINOMETRA.

Echinometra Rond. 1554. De Piscib. (Breyn).

Test thin, elongate, the longer axis making an acute angle with the anterior axis, the madreporic body being placed on the right of this long axis. Tubercles large, imperforate, not crenulate, slightly smaller in the ambulacral area. Poriferous zone moderately broad, pores arranged in very prominent arcs of many pairs. Actinostome large, actinal cuts shallow and often broad. Jaws very powerful, and auricles very massive. Spines long, longitudinally striated, quite stout; there are usually clusters of spines on the ten buccal plates of the actinal membrane,—a feature which distinguishes this genus from the true Strongylocentrotus, with which it is far more closely related than has usually been considered to be the case. The obliquity of the axis passing through the madreporic body and the opposite ocular plate is an embryonic feature, arising from the closing up of the open spiral which forms the first foundation of the Echinus in the Pluteus; when this spiral becomes first closed, it is always eccentric, but becomes symmetrical in the other Echinidae, with the exception of the true Echinometradae where the obliquity remains through the adult stages.

Nowhere among the young regular Echini have I found such great changes in the shape and proportions of the test and spines as in Echinometra. We frequently find specimens of the same size, where in one case the outline is almost circular, the test flattened, covered with long slender spines, while in the other the test is lobed, swollen, high, surmounted by numerous short stout spines. These and all intermediate stages, complicated by the greater or smaller number of primary tubercles, the arrangement of the arcs of the poriferous zone undergoing changes exactly similar to those described in Strongylocentrotus, are found existing in specimens of very different size. This has given rise in a great measure to the confused synonymy attached to our most common species, and renders their identification, if based upon meagre material, almost hopeless.

poriferous zone also is wider proportionally, the actinal opening is larger, and no trace of branchial cuts can be seen in specimens measuring 12.7mm., the arrangement of the miliaries is more regular, and they early have the two vertical rows of primary tubercles well developed.

Echinometra subangularis

! *Cidaris* **subangularis** LESKE, 1778. KL. Addit.

! *Echinometra subangularis* DESML. 1837. Syn., p. 266.

Pl. X[a]. *f. 2, 3, 4.*

Poriferous zone broad; pores arranged in arcs of not more than seven pairs, usually six; pores of a pair large, distant; abactinal system narrow; madreporic genital far exceeds in size the other genital plates, which are small, with large genital openings. What is specially remarkable in the West India species is the great size of the auricles, extending in a T-shaped broad column half-way the length of the polar axis, connected by a robust ridge at base, equalling in height one third of the auricles. Auricular arch small. Actinostome large and pentagonal; the number of coronal plates of ambulacra in young specimens is materially greater than in the interambulacra, but older specimens do not show a striking difference in the size of the primary tubercles of the two areas. The variation in proportion of the test, the structure of the ambulacra near the actinostome (more or less petaloid), the proportions of the spines and the test, are so great that it is only by examining a large series of specimens that good characters, which are but few, can be enumerated to distinguish this from the other species of Echinometra.

The color of the spines varies greatly from a dark violet-green to a deep violet almost black. With increasing age, as the test becomes more gibbous, the coronal plates increase greatly in size, and the primary vertical rows of tubercles often attain an extraordinary size, which has caused them, when flattened, to be mistaken for genuine Stomopneustes.

No. Primary interamb. Tubercles.	No. of Pores.	Diam. Actinal. System.	Diam. Abactinal. System.	Spine.	Diameter.	Height.
10	6	14.8	6.	18.	30.5	14.
11	6	19.	8.1	23.5	41	19.
13	7	21.	9.8	26.5	49.	22.
15	7	25.	11.	47.5	61.	31.
15	7	30.5	14.5	41.	75.	35.3
15	7	30.3	13.4		74.	36.5

From an examination of typical specimens of *Echinus lucunter* LAM. it became evident that Lamarck's species was the common Echinometra, having such an extensive range in the Pacific and Indian Oceans; extending from the Sandwich Islands to the Red Sea. It was with some doubt, however, that the name **Michelini** was adopted in the Museum Bulletin for our common West India species, the varieties of which have served as the type of many species: the large, somewhat oblong, swollen-sided adult, with short

stout spines, has been the *Echinometra lobata* BLAINV.; the flatter, more circular variety, with long slender spines, has even been referred to a different genus, Heliocidaris, by Hupé. Authors generally have referred the young flat stage to *Heliocidaris* **mexicana** AG.

Lütken supposed that the common West India Echinometra was the Echinus lucunter of Linné, and both he and Professor Lovén think the tradition of Linné's species points that way; unfortunately the labels of the Coll. Lud. Ulric. Reginae in the Museum of Upsala have been lost, so that it is impossible with precision to determine what Linné meant, and as there is no doubt as to what Lamarck meant by his E. lucunter, I have retained the name for the common Pacific species, and would have retained for our West India species the name E. acufera, as had been done before by Müller, were it not that the types which have served as the Cidaris subangularis of Leske are still preserved in Erlangen, leaving us no choice in the matter.

It is somewhat remarkable that, with the extensive geographical distribution of this species (the whole coast of Brazil, the Gulf of Mexico, Caribbean Sea, West India Islands, Bahamas, Bermudas, and W. coast of Africa), it should be so limited in bathymetrical range.

Littoral 6 to 7 fathoms.

Echinometra viridis

! *Echinometra* **viridis** A. AGASS. 1863. Bull. M. C. Z., I.

Pl. X^a. f. 1.

At once recognized by its prominent bare abactinal system with equally developed genital plates. The anal plates are large, bare, one or two of the larger ones having a single spine, the genital plates carrying but a single small tubercle near the anal edge; the ocular plates are completely excluded from the anal system, the madreporic plate scarcely larger than the other genital plates. The poriferous zone narrow, the arcs confluent, the pores arranged in arcs of usually five, though sometimes six pairs.

The spines in all the specimens examined are of a dirty green color, tipped with olive, with frequently a white milled ring. The actinostome is nearly circular, the actinal cuts shallow but sharp for this genus, the auricles slender, short, with a large auricular opening and low connecting ridges. The secondary rows of tubercles of the interambulacral space are irregular, made up of small secondaries, and in ambulacra are mere granules.

The tubercles are large and prominent, though the boss is low; the coronal plates are high.

Diameter.	Height.	Abactinal System.	Actinal System.	Anal System.	No. Prim. Tub.	No. Pores.	Spine.
37.5	19.	8.5	15.5	4.2	10	6	19 (*worn*)
29.5	14.2	8.5	14.2	3.5	10	5	
29.	14.	7.	13.	3.	10	5	28
21.	10.	6.	12.	2.3	9	5	19

As in Echinometra subangularis there is a flat long-spined variety of Echinometra viridis, distinguished formerly as Echinometra plana, but which the full series now in the Museum collection shows decidedly to hold the same relation to E. viridis which Heliocidaris mexicana AUCT. holds to E. subangularis.

Same bathymetrical range as former species; much less common.

ECHINIDAE.

Family **Echinidae** AGASS. C. R. Ann. Sc. Nat. VI. 1846. (emend.)

TEMNOPLEURIDAE.

Subfamily **Temnopleuridae** DESOR, 1855. Syn. Éch. foss.

TEMNECHINUS.

Temnechinus FORBES, 1852. Brit. foss. Tert. Echinod. p. 5.

Small Echini, test globular, primary tubercles in two principal vertical rows; secondary tubercles irregularly packed round base of primaries and edge of pits situated in median ambulacral and interambulacral spaces. Poriferous zone narrow, confluent, undulating; pores sunken, tubercles smooth and imperforate, actinal cuts slight, actinal membrane bare. Abactinal system prominent, genital plates well developed, genital openings in grooves. Anal system covered by one large conical plate, anal slit on edge of this and covered by three or four small plates. Spines short, slender, somewhat transparent, resembling those of Salmacis; auricles slender and closed.

Temnechinus maculatus

! **Genocidaris maculatus** A. Agass. 1869. Bull. M. C. Z.
! *Temnechinus maculatus* A. Agass. 1872. Rev. Ech., Pt. I.

Pl. VIII. f. 1–18.

Having examined lately several species of Temnechini from the London Crag, contained in a fine collection of fossils from the Crag, sent to the Museum by Dr. Quimby of Liverpool, I am inclined to regard this as a living species of Temnechinus, although it presents, even in the largest specimens received, very marked differences from those of Temnechinus figured by Forbes in his British Tertiaries.

This small Sea-urchin was described in the Preliminary Report as Genocidaris maculata (*Pl. VIII. f. 1*). It is closely allied to Opechinus, which Desor separated from Temnopleurus. The spines (*Pl. VIII. f. 5*) resemble in their structure those of Temnopleurus, but are shorter; the Sea-urchin with its spines resembling a Psammechinus, and having, like it, a large number of secondary tubercles, of nearly uniform size, closely crowded together (*Pl. VIII. f. 4*), but of a peculiar chiselled structure round the base of the primaries (so that it may be said that this genus is a Psammechinus among Temnopleuridae), there is a principal row of tubercles in the ambulacral and interambulacral area larger than the others. The poriferous zone is narrow; the pores, separated by an arched ridge, are arranged in an unbroken, slightly undulating, vertical row. The primary tubercles are smooth, imperforate. Near the base of the tubercle in the interambulacral spaces the test is ornamented by pits specially marked near the suture of the plates; in small specimens (*Pl. VIII. f. 11*), the small tubercles are frequently connected by a ridge with the main tubercles, and in still younger specimens (*Pl. VIII. f. 14*), before the secondary tubercles are well separated from the ridges, they form spokes radiating from a hub, similar to the structure of the tubercles in Glyphocyphus radiatus, and some species of Echinocyphus. The genera Opechinus, Microcyphus, Trigonocidaris, and Temnechinus form a transition between Echinus (Psammechinus) and Temnopleurus. The actinal membrane is bare, with the exception of the ten small circular buccal plates. The actinal opening is not large, with slight indentations (*Pl. VIII. f. 2*); in smaller specimens the actinal system is nearly circular (*Pl. VIII. f. 15*), the test is irregularly covered with pedicellariæ, having a blunt head surmounting a long, slender stem, articulating upon a shorter, stout rod (*Pl. VIII. f. 6*). The abactinal system is peculiar, as we find in the largest specimens even

(*Pl. VIII. f. 1*), which appear fully developed, but a single circular plate (*Pl. VIII. f. 3*), slightly conical, occupying nearly the whole anal system, with the exception of a small crescent-shaped anal slit, covered by four very small plates. The genital plates are large pentagonal, with a deep groove, in which is situated the genital opening, having on the anal edge a cluster of three or four small tubercles; the ocular plates are also pentagonal, elongated horizontally, indented slightly. The color of the test is greenish (in alcohol), often mottled with dark violet patches: the spines are of the same greenish tinge, banded irregularly with reddish transverse bands. In other specimens we have the same pattern of coloration, in different shades of green, with white spots irregularly scattered over the surface, or the median ambulacral and interambulacral spaces are colored, the tubercles rising prominently from this deeper background; the anal edge of the genital plates is similarly colored. On *Pl. VIII. f. 30*, is given a part of the test of **Temnechinus globosus** of FORBES, from a specimen considerably larger than the specimen of T. maculatus (*Pl. VIII. f. 1*), when the pits, which exist at the base of the tubercles (*Pl. VIII. f. 4*), are just commencing above, while they are well developed in the part of the test of the fossil species represented, but coincide in the structure of the upper part of the test with the living specimens. The changes due to growth in the recent species of Temnechinus are striking, the different stages from the perfectly smooth uniform granulation of the smallest specimen collected (*Pl. VIII. f. 17*), with its immense actinostome, through those represented in *Pl. VIII. f. 14*, to *f. 11*, and to *f. 4*, would scarcely be credited to belong to the same species were it not for the complete series collected. The different habitus of the oldest and smallest specimen collected is best seen by contrasting (*Pl. VIII. f. 16* and *Pl. VIII. f. 1*) the two extreme sizes of this species collected by Mr. Pourtalès. In the youngest stage (*Pl. VIII. f. 16*), the spines are slightly flattened, pointed, swollen in centre, serrated, longitudinally striated; they equal in length the diameter of the test, are few in number, and remarkably large, here and there some smaller spines having the same structure as the larger, and a few club-shaped embryonic spines, not yet articulated. The test is flat, pentagonal, is not separated into plates, has no abactinal system proper yet specialized, beyond the single large plate of the anal system and the large genital openings, in the limestone network. In a somewhat older stage the spines cover the test more closely concealing the anal plate, they have lost their fusiform shape and take the form of spines figured in *Pl. VIII. f. 18*, still retaining sufficiently the

structure and coloration of the fusiform spines to show their connection. The test denuded and magnified presents the peculiar hub-shaped arrangement of the ridge to form the secondary tubercles round the base of the primaries (*Pl. VIII. f. 14*). When somewhat older the actinostome is much smaller (*Pl. VIII. f. 15*), slightly angular, the genital plates not yet distinctly formed. In the following stage (*Pl. VIII. f. 8, 9*), the pits at the base of the tubercles are quite marked (*Pl. VIII. f. 11*), the spines are about a third the diameter of the test, but have quite the general aspect of those of larger specimens (*Pl. VIII. f. 12*). The abactinal system is well formed, the genital plates rising above the level of test, are pentagonal, deeply grooved for the opening of the genital openings, the madreporic body prominent (*Pl. VIII. f. 10*), and a single conical plate fills the whole of the anal system. The auricles resemble those of some species of Temnopleurus (*Pl. VIII. f. 13*).

The largest specimens collected (*Pl. VIII. f. 1, 4*) have the same structure in the middle of test which is found in the youngest plates of Temnechinus, showing that eventually these incipient pits will fall together, forming pits similar to those of the fossil species (*Pl. VIII. f. 30*). The outline of the test is regularly arched, slightly flattened at top (*Pl. VIII. f. 7*). The changes in the poriferous zone are slight, the zone of the older specimens being somewhat undulating (*Pl. VIII. f. 4*) or angular, while in younger specimens the poriferous zone is vertical (*Pl. VIII. f. 14*); the ridges separating the pairs of pores becoming more distinct with age, and the pores more sunken.

From 30 to 160 fathoms.

Among the Temnopleuridae the changes due to growth are very prominent; hence the difficulty of recognizing the species thus far established, as the descriptions belong to specimens not identical in age. It would be hardly possible to recognize in *Pl. VIII. f. 22* and *Pl. VIII. f. 24* corresponding portions of the test of Temnopleurus Reynaudi; the sharp, deep, rectangular pits at the sutures of the plates (*Pl. VIII. f. 24*), taken with the peculiar anal system of this stage of growth (*Pl. VIII. f. 23*), with its large elliptical anal plate covering nearly the whole anal system, would certainly warrant us in separating these specimens from those with wide, diffuse, triangular depressions at the sutures of the plates (*Pl. VIII. f. 22*), having prominent, isolated, comma-shaped secondaries round the primary tubercles, and an anal system in which, although one plate is much more prominent than the others, yet is relatively small compared to the size of the anal system (*Pl. VIII. f. 24'*).

Similar changes of growth are observed in Temnopl. Hardwickii (*Pl VIII. f. 25, 26*). The secondary tubercles appear at first like radiating spokes. The pits are sharp, rectangular (*Pl. VIII. f. 25*), while in somewhat older stages they are more circular (*Pl. VIII. f. 26*), the secondary tubercles isolated, and eventually these pits become mere smooth, bare, angular spaces at the junction of the plates in the adult. The increase in number of plates of the anal system, due to age, is seen in comparing *Pl. VIII. f. 28* and *Pl. VIII. f. 27*; the anal system undergoing changes similar to those of the anal system of Toxopneustes, Echinus, and the like, where no one plate retains a greater prominence, as is so markedly the case in Temnopleurus, where the plate, originally covering the whole anal system, is peculiarly ornamented, and retains throughout its characteristic features, and is readily distinguished (*Pl. VIII. f. 24'*) in the oldest specimens from the plates subsequently added in younger specimens.

D'Archiac and Haime have figured from the Nummulitic formation of India a number of species, which are usually referred either to Temnopleurus or to Opechinus, which belong to this same genus Temnechinus.

TRIGONOCIDARIS.

Trigonocidaris A. AGASS. 1869. Bull. M. C. Z., I.

Small Echini, test thin, regularly arched above, depressed below; actinal cuts slight, actinal membrane strongly imbricated. Two principal vertical rows of tubercles, both in the ambulacral and interambulacral areas; secondaries and primaries connected by ridges raised above test, forming an irregular network of ridges, with more or less deep pits between them; poriferous zone narrow, pores arranged in single vertical pairs, spines longitudinally and laterally striated. Abactinal system large, genital plates excluding smaller ocular plates from anal system, which is covered by four plates.

Trigonocidaris albida

! **Trigonocidaris albida** A. AG. 1869. Bull. M. C. Z., I.

Pl. IV. f. 1–7.

Small species, in which the primary tubercles have the same structure as in Temnechinus; but, in addition, the whole test is covered by a reticulation of ridges, similar to those of Podocidaris, but more numerous and quite

irregular (*Pl. IV. f. 3*), extending from the base of the different tubercles, both primary and secondary, and uniting them all in a complicated, raised system of network, with irregularly shaped cells, the ridges leaving more or less deep pits, giving the test the appearance of having been gouged out in spots (*Pl. IV. f. 1*). The spines are long, slender, somewhat transparent, longitudinally striated, with slight transverse striation (*Pl. IV. f. 4*). The abactinal system resembles that of Hemipedina, but the anal system is covered by only four triangular plates, one of which is much larger than the others (*Pl. IV. f. 1*). From the fact that in the youngest specimens examined we find them already, I am tempted to suppose they never increase in number, and remain as they are, as in Arbacia. The actinal membrane is, as in some species of Toxopneustes, entirely covered by a number of rather large plates irregularly arranged, the ten buccal plates being but slightly more prominent (*Pl. IV. f. 2*) than the others. The actinal opening is of moderate size, slightly indented; the auricles are exceedingly slender, and disconnected at the extremity. There are but two principal rows of primary tubercles, both in the ambulacral and interambulacral zone, with but five to six minute tubercles seated upon the connecting ridges in the latter zone, and two or three upon each plate in the former. The poriferous zone is narrow; the pores are placed obliquely in an unbroken vertical zone, three to each ambulacral plate, and separated by ridges running from the ambulacral tubercles to the interambulacral zone, similar to those joining the tubercles. The test, as well as the spines, are almost white, the latter having only a slight tinge of yellow when largest. The whole test is covered with pedicellariæ (*Pl. IV. f. 5*), having a large pointed head articulated upon a long, comparatively slender peduncle, seeming scarcely capable of supporting the bulky head.

In younger specimens (*Pl. IV. f. 6*), the reticulations connecting the smaller number of larger tubercles are broader, the pits less numerous and not so deeply cut (*Pl. IV. f. 7*); the secondaries, however, show no regular arrangement, the spines are comparatively longer, the arrangement of the poriferous zone is the same, and the abactinal system does not vary materially from the older specimens figured. The only approach we have to a similar reticulation in any other genus is in Echinocyphus, but then it is limited to a few spurs radiating from the primary tubercles like spokes.

From 40 to 270 fathoms.

TRIPLECHINIDAE.

Subfamily **Triplechinidae** A. AGASS.

(PSEUDODIADEMA.) HEMIPEDINA.

Hemipedina WRIGHT, 1855. Brit. Ool. Echin.

The small number of living specimens of the genera belonging to Pseudodiadematidae thus far found renders it extremely difficult to form any opinion of the characters hitherto employed to distinguish the genera allied to Phymosoma and Pseudodiadema. It seems pretty evident that there have been too many generic divisions introduced, but I am unable from the material thus far collected to give any satisfactory limitation of the genera of Pseudodiadematidae, resting as they do upon the presence or absence of crenulation and perforation of the tubercles. For this reason I prefer, until better characters can be pointed out than those upon which I based my separations from Hemipedina of Caenopedina, to regard this genus as identical with Hemipedina, regarding Hemipedina at the same time as a subgenus of Pseudodiadema, from which it differs only in having smooth tubercles, not crenulate, and having deep actinal cuts and smaller ambulacral tubercles.

The genus contains Echini having but two principal vertical rows of tubercles in the ambulacral and interambulacral areas, the ambulacral tubercles smallest, both perforate but not crenulate. Poriferous zones simple, forming arching curves round the primary tubercles. Actinal cuts marked, ten large buccal plates. Abactinal system large, not prominent. Spines long, slender, longitudinally striated. The poriferous zone resembles that of Orthopsis, having also, like it and Echinopsis, perforate but not crenulate tubercles. It resembles Acrosalenia as well as Phymosoma, of which the tubercles are, however, crenulate and not perforate.

Hemipedina cubensis

! **Caenopedina cubensis** A. AGASS. 1869. Bull. M. C. Z., I.
! *Hemipedina cubensis* A. AGASS. 1872. Rev. Ech. Pt. I.

Pl. III. f. 1–7.

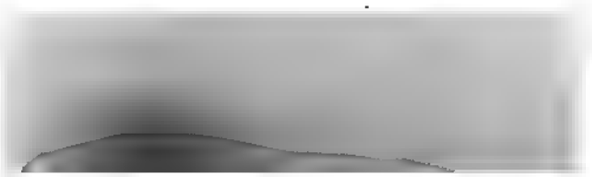
This species is a living representative of the genus Hemipedina of Wright (as emended by Desor, Wright having included in it species of other genera of Pseudodiadematidae). It differs from its fossil representative by the peculiar arrangement of the pores, which have a tendency to arrange themselves

in lateral arcs of three pairs (*Pl. III. f. 4*). The general outline of the test is that of Phymosoma, there are only two rows of tubercles extending from pole to pole; the flatness of the abactinal part of the test (*Pl. III. f. 5*), and the great development of the abactinal system, remind us of some forms of Hemipedina, as, for instance, *Hemipedina* **Guerangeri** Cott. et Trig., figured in *Pl. XXII. f. 5*, Échin. de Sarthe. The actinal opening is small, with sharp cuts for the passage of long, narrow gills (*Pl. III. f. 2*). The spines are long, moderately stout, as long as the diameter of the test, longitudinally striated, resembling the spines of some species of Hemipedina figured by Wright. The pores are arranged in vertical connected arcs, of from three to four pairs. There are two rows of perforate primary tubercles in the ambulacral area, decreasing rapidly in size towards apex, and placed close together (*Pl. III. f. 3*). They are considerably smaller than those of the interambulacral area. There are one or two small imperforate tubercles at the base of the larger ones. The poriferous zone is broad and well defined, spreading slightly at actinostome (*Pl. III. f. 2*).

The perforate interambulacral tubercles are arranged in two primary rows, separated from the poriferous zone by a row of small imperforate tubercles (*Pl. III. f. 3*), with two or three similar irregular rows between the larger tubercles in the median interambulacral zone. The pedicellariæ of test, near the abactinal pole, have very large, broad, open arcs (*Pl. III. f. 6*), when full grown, resembling those of Echinus proper; the young pedicellariæ (*Pl. III. f. 7*) are more compact. The plates of the abactinal system are large (*Pl. III. f. 1*), with straight sides; the genital are heptagonal, carrying five to six small tubercles, and as many still smaller ones. The ocular plates are pentagonal, with a large ocular pore surrounded by an arc of small tubercles. The plates covering the large anal system are very numerous and minute. The anus is situated in the very centre of the anal system. The teeth resemble those of Arbacia. The buccal membrane is strengthened round the mouth, close to the teeth, by ten large plates (*Pl. III. f. 2*), (perforated for buccal tentacles,) occupying nearly the whole membrane, with eight to ten very much smaller ones between the large plates and test. The color of the large spines, in alcohol, is of a dull yellowish-green, while the smaller spines, as well as test and abactinal plates, have a more yellowish tint.

Diameter.	Height.	Abactinal System.
11.2	4.8	6.4

From 138 to 270 fathoms.



ECHINUS.

Echinus Rond. 1554. De Piscib. (Linn.). (emend.)

This genus, as limited by Desor, contained only species more or less globular, having comparatively small tubercles, smooth, imperforate, of nearly equal size on the two areas, forming but two principal vertical rows upon the coronal plates upon both areas, the other tubercles being smaller and irregularly arranged. Actinostome small, with but slight cuts. Buccal membrane bare, with only the ten buccal shields. Spines comparatively stout, frequently attaining a considerable size, in some of the species equalling the test in diameter. Pores arranged in arcs of three. Jaws comparatively weak, auricles slender.

Lütken has first thrown doubt upon the validity of this genus, and is inclined to consider the species of Psammechinus also as true Echini. If we were to found this genus simply upon the presence or absence of the plates upon the buccal membrane, his objections would be well founded. It may be objected that we must take into account the facies of the tubercles, the close arrangement of the miliaries and secondaries contrasted with the sparse and regularly placed primary rows of the true Echini, and the totally different structure of the abactinal system, which would seem to justify us in considering Psammechinus as a subdivision, certainly ranking as a subgenus of Echinus proper; yet in Echinus sphaera we find the young so closely resembling the typical Psammechinus that we plainly see that the objections to Lütken's proposition are not based upon solid ground.

Echinus gracilis

! *Echinus* **gracilis** A. Agass. 1869. Bull. M. C. Z. I., No. 9.

Pl. VI^a. f. 6; Pl. VII. f. 1–6.

This species holds an intermediate position between E. **Flemingii** Ball and E. **melo** Lam., to both of which it is allied. Like the former, it is subject to great variations in the ratio of the longitudinal and vertical diameter of the test. The primary tubercles are larger than those of E. melo, but smaller than those of E. Flemingii. The spines in the proportion they bear to test are similar to those of E. melo. The general pattern of coloration is the same, consisting of bands of green made up of irregularly shaped lozenges running in vertical rows, diminishing in intensity towards actinostome, the

intermediate spaces forming brilliant white or straw-colored bands. In one of these white bands is placed the poriferous zone, and each primary row of tubercles is placed in a similar band at the junction of the points of the green lozenges. Thus the test is divided into twenty bands alternately green and white; the poriferous zones, and two principal rows of tubercles being separated by these dark green lozenges, giving the test a most graceful pattern of coloration. The abactinal system is compact and circular; the shape of the genital plates is a pointed pentagon somewhat as in E. melo, while in Flemingii they are heptagonal. The madreporic body is reduced to a narrow band across the genital plate. The anal system is made up of a large number of small plates. The ten large plates of the buccal membrane are quadrangular with rounded corners, carrying stout pedicellariæ similar to those of E. melo. The position and general arrangement of the tubercles is similar to E. melo; the large tubercle is placed in the centre of the interambulacral plate, which carries in addition short horizontal rows of two or three minute tubercles, the row near the horizontal suture being the most prominent. In the ambulacral zone the main tubercle has a similar position; the small tubercles are placed close to the median suture, and form irregular vertical rows. Two kinds of pedicellariæ are scattered over the whole surface of the test, supported upon distant miliaries, both in the ambulacral and interambulacral areas. The short-stemmed, thick-headed ones are similar to those of E. melo. The long-stemmed have a triangular, sharp elongate head at the extremity of a very slender stem, with wide arched openings. The distance between the milled ring and the articulating surface of the shaft of the spine is greater than in either of the allied species of Echinus.

Diameter.	Height.	Actinal System.	Abactinal System.	No. of Interamb. Plates.
65.8	69.5	21.5	11.7	28
42.4	57.9	15.8	12.	24
64.2	67.	17.	12.5	25
37.2	34.1	12.	8.7	19
10.1	5.0	5.	2.5	10
12.	17.	5.1	4.2	12

In younger specimens the smaller tubercles of the interambulacral spaces form irregular vertical lines, two on each plate; the miliaries are less numerous, the anal plates larger and fewer in number, and the white bands of the poriferous zones better marked; the ten buccal plates are thickly studded with stout pedicellariæ.

In still younger specimens, measuring from 10$^{mm.}$ to 15$^{mm.}$, the elegant

markings of the older specimens are scarcely laid out even towards the abactinal region, where in the older specimens they are most distinct. The main vertical rows of the primary tubercles, both of the ambulacral and interambulacral, are very prominent; miliaries are almost absent, the anal system of the youngest specimen being covered by five plates, one of which occupied nearly the whole of the anal system. This species attains a considerable size; specimens are in our collection measuring 65.8 in diameter, and another 78$^{mm.}$ in height, exceeding somewhat the transverse diameter.

In Echinus, as in Toxopneustes, we find in the younger stages (*Pl. VII. f. 2, 4*) the same unbroken vertical arrangement of the pores, taking next a vertically arched form, still connected, and then assuming the arrangement of the adult. In these genera the anal system is at first covered by one plate, and undergoes changes similar to those of Strongylocentrotus, by the addition of four smaller plates (*Pl. VII. f. 1*), and so on (*Pl. VII. f. 3, 5, 6*), the original subanal plate retaining long a greater prominence. The miliaries are formed in these genera as well as Strongylocentrotus by radiating ridges arising from the base of the primary tubercles, forming a sort of star (*Pl. VII. f. 2*); then they swell at the distal extremity, forming a set of club-shaped spokes round the main tubercle; these are little by little separated from it, and become independent elliptical tubercles at first, and then miliaries or secondary tubercles. The ten large buccal plates of the actinal membrane are the first to appear. Small plates (in genera in which they are found in the adult) are next formed between them and the teeth, while afterwards they cover the whole membrane, as in Toxopneustes and Trigonocidaris,—a mode of growth of the actinal buccal plates totally different from that of the buccal plates of Cidaris, where new plates are added next to the coronal plates of the test, carrying the poriferous zone along with them.

In young specimens of Psammechinus microtuberculatus we have a structure similar to that of the young of Echinus proper (*Pl. VIII. f. 19–21*). The poriferous zone is vertical, there being no tendency as yet, in specimens measuring 5$^{mm.}$ in diameter, for pores to form arcs of three pairs; the tubercles are already closely crowded together, but no more than is the case in young specimens of E. sphaera of the same size, where we see, perhaps better than in any other species, the impossibility of separating Psammechinus as usually understood from Echinus proper as has been maintained by Dr. Lütken. In Hipponoe the lateral spreading of the pores takes place very rapidly

(see *Pl. VIII. f. 29*), while in Psammechinus the pores frequently remain vertical so long that we might be tempted, as has been frequently the case in allied fossil species, to retain the adult in the genus Arbacia Agass. non Gray, from the impossibility of stating confidently whether the pores were arranged in arcs of three pairs or not.

Echinus norvegicus

! *Echinus* **norvegicus** Düb. o. Koren, 1844. Skand. Echin.

Pl. VI. f. 4.*

Test flat, slightly conical, depressed. Abactinal system prominent, compact, raised above level of test. Anal system small, genital plates large, with large genital openings, and prominent secondary tubercles on part near anal edge. Two principal vertical rows of primary tubercles in ambulacral and interambulacral space, with two shorter vertical rows of larger secondaries extending from actinostome to ambitus, in interambulacral space, on each side of primary row, and from ten to twelve secondaries on each plate, with intermediate spaces filled by miliaries. Ambulacral space narrow, plates well covered by secondary and miliary tubercles except along median line near abactinal region where bare as well as in the interambulacral median space. Mouth rather larger than in other species of Echinus of its size. E. norvegicus, like E. elegans, is flattened below, with the actinostome somewhat depressed. Primary spines straw-colored, long, sharp, tapering; secondaries, same color, attaining about one half the diameter of the test.

The variations of species of true Echinus are very considerable, the species recognized are by no means discriminated with the accuracy which is required, and the differences of opinion prevailing respecting the number of species of this genus, as is readily seen by examining the Synonymic Lists of various writers, show how much remains to be done. The remarkable uniformity in appearance of the specimens of the allied species of E. elegans, norvegicus, Flemingii, melo, and the absence of complete series of different sizes of the different forms, seems to make it impossible at present to characterize these species with great accuracy; and I give with great hesitancy such differences as I have noticed which appear constant, stating at the same time that E. Flemingii, E. elegans, and E. norvegicus may yet turn out identical species, as well as E. gracilis and E. melo, though the material at command in the different Museums does not at present justify such a position.

I had not, when writing the Preliminary Report, seen a good series of

Echinus norvegicus and referred the single small specimen to Echinus Flemingii. It is a young Echinus norvegicus of which the Museum now possesses a good set of specimens, thanks to Professors Thomson and Lovén and Dr. Lütken.

The younger Sars has separated as distinct from E. norvegicus, under the name of E. rarispinus, specimens which are in my opinion only very globular E. norvegicus; under the name of E. depressus, large flattened specimens with remarkably large and stout spines of an umber color, tipped with pink, equalling in length more than half the diameter of the test, with a somewhat larger anal system, more like that of E. elegans, and in which the secondaries are arranged in circles round the primaries upon the somewhat higher coronal plates. The series of specimens dredged by the Porcupine Expedition plainly shows this to be a modification of the typical E. norvegicus, which previously had been known mainly from small specimens, very few of them measuring more than one to one and a half inches in diameter having been found previously.

TOXOPNEUSTES.

Toxopneustes Agass. 1836. Prod. (non Agass. Des. 1846).

Ecnini with test more or less conical, tubercles of uniform size, arranged in several vertical rows in interambulacral and ambulacral spaces. Poriferous zone broad, pores arranged in inclined arcs of three pairs, in the larger species forming three irregular vertical rows resembling the arrangement of Hipponoë. The actinostome is large, the cuts are deep, the buccal membrane thickly plated with large imbricating plates. Spines short, moderately stout.

My attention was first called to the affinity of Boletia and Lytechinus from a comparison of young Boletia pileolus and Boletia rosea with young specimens of Lytechinus; the former had all the features of Lytechinus, except of the plated buccal membrane. A closer examination of the subject shows that no positive character can be drawn to distinguish the two genera except the presence of the plated buccal membrane of Lytechinus. The peculiar pedicellariæ so finely developed in Boletia also occur in Lytechinus, but are much less numerous and also much smaller. The structure of the abactinal and actinal systems, the general structure of the ambulacral

system is the same in the two genera. In old specimens of Boletia we find, during the growth of the poriferous zone, that new plates are frequently added at any point of the poriferous zone, thus introducing an element of irregularity in the trigeminal arrangement, giving a greater preponderance to the apparent vertical arrangement of the pores which is not found in Lytechinus, though in young Boletia maculata, and up to the largest size, the mode of growth of the poriferous zone is the same as in the typical Lytechinus, and in this species of Boletia the general features of Lytechinus are retained; unfortunately the buccal membrane of B. maculata is not preserved in any of the specimens examined, and I am unable to show any correlation between these characters. For the present it does not seem advisable to maintain Lytechinus even as a subgenus of (Boletia) Toxopneustes, until we know something more of the Boletia maculata.

Toxopneustes variegatus

! *Echinus variegatus* (**Lamk.**) 1816. A. s. Vert.

! *Toxopneustes variegatus* A. AGASS. 1872. Rev. Ech., Pt. I.

Pl. II. f. 5, 6; Pl. IV^a. f. 4, 5; Pl. VII. f. 7–20.

The tubercles both of the ambulacral and interambulacral areas are arranged in perfectly regular vertical rows, closely packed on lower surfaces in interambulacral area, but one vertical row of large tubercles extending from ambitus to the apex, the one next to the poriferous zone gradually becoming much smaller, while the others, according to the size of the specimens, extend more or less towards the abactinal region, leaving a bare median space on which the granulation of the plate is very fine and compact. The secondaries are far apart and irregularly scattered round the primaries. In the ambulacral space the outer vertical rows alone extend to the abactinal region, the others but a short way above ambitus, leaving a bare median space as in the interambulacral space. The spines vary very much in thickness and coloration. The variety with long, slender spines, with a greenish coloration of test, has been called E. variegatus; specimens with a uniform yellowish or violet tint, having at same time generally blunter, stouter, and shorter spines, have received the name of carolinus and atlanticus. The actinal cuts are moderate; the buccal membrane is completely covered by large, very prominent plates, closely packed together. The depression of the median interambulacral space near apex, so common in Boletia rosea, leaving the ambulacra raised, is frequently found in this species also.

No. Primary Tubercles	Diameter.	Height.	Actin System.	Abactinal System.
31	72.	39.9	21.2	11.5
25	59.5	32.3	17.4	11.
22	47.5	25.4	16.1	7.5
22	39.1	23.	15.2	
20	34.2	18.3	13.7	

More abundant material collected by the Thayer Expedition from St. Thomas, Rio Janeiro, and along the whole coast of Brazil by Messrs. Allen and Hartt, by Mr. Bickmore at the Bermudas, and by Mr. Pourtalès, in the Deep-Sea Dredgings of Florida, reduces the number of species of this genus, which had been distinguished by my father and myself, to the original E. variegatus of Lamarck. The extensive series of large specimens brought to the Museum by the Thayer Expedition, collected at every point from Rio as far as St. Thomas, shows an extent of variation which is most surprising, while the young specimens collected by Pourtalès show an equal variability, leaving none of the characters upon which Lytechinus carolinus or Lytechinus atlanticus had been established as sufficiently permanent to warrant their separation from Lytechinus variegatus. Yet, as is generally the case in species of extensive geographical range, we find a few features which seem to characterize the majority of specimens found at different localities, while others again have such combinations of characters as show unmistakably the gradual transition of all the features by which these so-called species have been distinguished. The specimens from South Carolina, Georgia, and the shores of both sides of the peninsula of Florida, as well as Alabama and Louisiana, usually possess slightly stouter spines, a somewhat thicker test, and larger tubercles. Those of West India Islands, as well as the south shore of Cuba, have a thinner test and rather more elongate spines. The specimens from the Bermudas have more closely crowded tubercles and slender spines. In the specimens collected by Mr. Pourtalès at thirty-four fathoms, we find slender spines and the primary tubercles far apart, leaving the test quite bare, when compared to the average of specimens of the same size of various localities. But when we take the series from Brazil, of which we have by far the greatest number, we find all these various characters combined alternately so as to leave no doubt that we have but one species extending from Rio Janeiro along the whole coast of Brazil, to the West India Islands, the shores of the Gulf of Mexico, Cuba, Florida, Georgia, South and North Carolina. Those features which are usually well marked as specific differences — the structure of the scales on the actinal membrane. the pedi-

cellariæ, and the abactinal system — agree in all specimens to a remarkable degree. In the Bulletin of the Museum of Comparative Zoölogy, I separated the genus Lytechinus from Psammechinus to which *Echinus variegatus* (Lam.) had been referred on account of the actinal notches, the regular arrangement in vertical rows of the primary tubercles, and the absence of secondary tubercles which fill so large a space on the coronal plates of Psammechinus miliaries, as well as the arrangement of the pores and the structure of the abactinal system; the arrangement of the tubercles of the test being similar to that of Magnosia, from which genus it differs, however, in not having the pores spreading near actinostome, but remaining trigeminate to the extremity of the ambulacra, having a more deeply notched peristome, which is much smaller, in comparison to the diameter of the test. Lütken, about the same time, though a few weeks later, as far as publication is concerned, distinguished this same genus on the same grounds which are given above, and has correctly referred to it, also, E. semituberculatus from the Galapagos Islands; but, as I have shown above, there is no good reason for separating Lytechinus from Boletia, and for not restoring to both these genera their original name of Toxopneustes.

This species has, like the common Echinometra, a great geographical range identical with it, but at the same time has a somewhat more extensive bathymetrical distribution.

Littoral to 34 fathoms.

In the youngest specimen examined, measuring 4.7^{mm} in diameter (*Pl. VII. f. 7*), the arrangement of the pores (*Pl. VIII. f. 8*) differed from that of the adult in being in vertical rows; the abactinal system was still quite imperfectly developed, having by no means the prominence and distinctness it attains in the adult, its structure being well shown already in specimens measuring 18.5^{mm} in diameter. In this smallest specimen the sutures of the genital plates were indistinct, the ocular plates could barely be distinguished, the whole anal system was covered by a large prominent plate, and on one side of it, next to the left ocular plate, opened the anus; the madreporic body was quite prominent, jutting out like a sponge above its genital plate. Both in the ambulacral and interambulacral areas, the two prominent rows of tubercles of the adult are well marked; there are nine coronal plates; buccal membrane, as in adult, covered with imbricating scales. In specimens somewhat older, there are no important changes, beyond those of the anal system, where the single plate is replaced by five, four other

smaller ones are found on its sides arranged $>^{\infty}_{\infty}$, so that the larger plate occupies the base of the V-shape, and the smaller plates the point where the anus opens (*Pl. VII. f. 10*). This specimen measured 9.1$^{mm.}$, and had eleven coronal plates; the genital plates have become slightly more distinct. It is, however, only in specimens measuring 10$^{mm.}$ in diameter, and having fourteen coronal plates, that the abactinal system becomes more prominent and the sutures well marked. In specimens measuring 11.2$^{mm.}$ in diameter the abactinal system is slightly raised, and numerous small plates of anal system have appeared, completely obscuring the original arrangement of the anal system.

HIPPONOË.

Hipponoë GRAY, 1840. Synops. Cont. Brit. Mus.

Echini of large size, with thin test, tubercles small and numerous, imperforate, not crenulate, arranged in horizontal and somewhat irregular vertical rows, median ambulacral and interambulacral spaces frequently bare. Actinostome small, but deeply notched Poriferous zones broad; pores arranged in three vertical rows, middle row sporadic, exterior ones regularly vertical. Ambulacral areas very broad. Spines short, moderately stout.

In retaining the name **Hipponoë** of GRAY, to which objections will undoubtedly be raised on the ground of Hipponoa having been before used by Audouin, and from the fact of the name alone appearing without further indications of its connection, I am simply carrying out the principle that Hipponoë and Hipponoa are two very different words, and that when specimens are accessible which have served as basis for any systematic work, their results should be accepted, when correct, even when they upset a nomenclature generally recognized.

Hipponoë esculenta

! *Cidaris esculenta* **(Leske)**, 1778. Addit. KLEIN.
! *Hipponoë esculenta* A. AGASS. 1872. Rev. Ech., Pt. I.

Pl. VI^{a}. f. 1–3; Pl. VIII. f. 29.

In large specimens measuring 110$^{mm.}$ we find twelve vertical rows of principal tubercles in the interambulacral space; the arrangement of the tubercles on each plate is more in horizontal rows; towards the median line,

which, from the ambitus to the abactinal pole, is more or less bare, the coronal plates are covered by miliaries. The third vertical row, counting from the poriferous zone, is the most prominent one, this and the adjacent one internally (towards median line) being the only ones to reach the abactinal system. The tubercles, as a general thing, are very uniform in size, except in specimens where much of the median line is bare, when the contrast between the main row (the third) and the other is more marked, more like primary and secondary. On the lower surface, both of ambulacral and interambulacral spaces, the tubercles are very uniform in size and closely packed in concentric rows round actinostome as centre. The median ambulacral space is filled by five more or less distinct vertical rows, quite marked at ambitus, central row indefinite, exterior being more prominent, also tending to arrangement in horizontal rows; the vertical lines of pores are separated by irregularly arranged vertical rows of secondary tubercles forming from two to three vertical lines.

Abactinal system well marked, madreporic body larger than others. Three ocular plates excluded from large anal system covered by a comparatively small number of plates of nearly uniform size, very few smaller ones immediately round anus, each plate carrying but one or two small secondary tubercles and few miliaries, the genital ring having but few secondary tubercles; near anal system they are more numerous, but also sparsely scattered over the rest of the genital and ocular plates. The actinal opening is small, with deep cuts; membrane covered by minute plates irregularly scattered, not closely crowded. Spines short, comparatively stout. Color of spine whitish or yellowish, test generally brownish, the median line frequently (interambulacral space) colored a beautiful violet. Young specimens in which the median interambulacral and ambulacral space are comparatively very bare have been described by Girard as **Heliechinus**. The central vertical line of pores of the poriferous zone is slightly nearer the inner line, though frequently almost in middle.

No. Primary Tubercles.	Diameter.	Height.	Abactinal System.	Anal System.	Actinal System.	Width Poriferous Zone.	Spine.
21	28.5	15.2	5.8	3.	10.	2.9	4.6
23	45.4	29.3	8.1	3.7	13.1	3.8	7.5
34	88.2	49.	12.	7.	23.2	7.8	12.
38	118.	67.	19.	10.9	26.2	9.1	13.

Heliechinus Gouldii of Girard (*Pl. VI^a. f. 3*), of which the original is in the Museum collection, is nothing but a young Hipponoë esculenta. In

spite of the apparent polyporous arrangement of the pores in three vertical rows, we find, on analysis of the plates, that, as Dr. Lütken has shown, there are but three pairs of pores for each ambulacral plate. With advancing age the arcs of these pairs of pores, at first quite distinct in young specimens, and still to be seen in the very uppermost part of the poriferous zone, gradually become more and more horizontal, and finally form three regularly vertical rows, due simply to lateral crowding and not to additional plates, as is readily seen in *Pl. VIII. f. 29*, the upper part of the poriferous zone of a young Hipponoë esculenta, showing the gradual changes taking place, from a vertical arrangement, as in Echinus, to the characteristic poriferous zone of Hipponoë.

Littoral to 10 fathoms.

When alive the color of the spines of Hipponoë esculenta is white or straw-colored, a darker color at the base, or brownish-yellow. The median interambulacral space is spotted with black, the color of the heads of the innumerable pedicellariæ, scattered thickly over the whole of that part of the test. The ambulacral suckers are white at tip, gradually passing to yellow, and finally the basal part of sucker is of a dark-brown color. So that when suckers are fully expanded, the tentacles form lighter bands, intermediate between the black bands of the median interambulacral spaces. The buccal membrane is reddish-brown as well as yellow, and the suckers near the actinostome are of the same color.

CLYPEASTRIDAE.

Suborder **Clypeastridae** AGASS. 1836. Prod. Mon. Rad.

EUCLYPEASTRIDAE.

Family **Euclypeastridae** HAECKEL, 1866. Generelle Morph.

FIBULARINA.

Subfamily **Fibularina** GRAY, 1855. Cat. Rec. Ech. (emend.)

ECHINOCYAMUS.

Echinocyamus VAN PHEL. 1774. Brief.

Small flattened Sea-urchins with a thick test. The ambulacra are very imperfectly petaloid, poriferous zones diverging or parallel, pores disconnected. The horizontal sutures of the ambulacral plates extending to the actinostome, pierced with a large number of pores, the pores most numerous above the ambitus. The interior of test has simple radiating partitions extending towards the central actinostome. The supports of the jaws (auricles) very tall and broad. Ambulacra broader than the interambulacra; tubercles of uniform size, extending over apical rosette; pores of madreporic body frequently as large as genital or ocular openings. Spines short, slender; anus inframarginal, situated near actinostome; genital pores four in number, small, indistinct; ocular pores large.

Echinocyamus pusillus

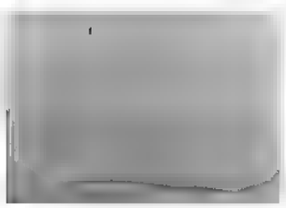
Spatagus pusillus MÜLL. 1776. Prod. Zool. Dan.
! *Echinocyamus pusillus* GRAY, 1825. Ann. Phil.

Pl. XI. f. 3; Pl. XIII. f. 1–8.

The species of this genus present great difficulties; their small size, the usually imperfect condition of their preservation, the great variation in the shape of the test, and the differences due to growth, make it extremely difficult to eliminate the special conditions of the specimens from the specific differences; as far as I can judge from the material at my command, many of the species have been based upon totally inadequate characters. The specimens

collected in Florida by Pourtalès were determined in the Preliminary Report as young of (Stolonoclypus) Clypeaster, basing my identification upon the peculiar structure of the ambulacral area. We find that the poriferous zone extends beyond the imperfect petals (*Pl. XIII. f. 6*), as a series of pores in the sutures of the ambulacral plates (*Pl. XIII. f. 2, 3*), across the whole width, from the base of the petals to the actinostome (*Pl. XIII. f. 4*),—a character which had not previously been noticed in Echinocyamus, though it was known in the flat species of Clypeaster from Müller's researches. Subsequently, however, on opening these small Echini, I found the characteristic radiating partitions of Echinocyamus, while specimens of Clypeaster subdepressus showed already the concentric pillars developed near the edge of test, as in *Pl. XIII. f. 11*, the small, high arched teeth of Echinocyamus also greatly contrasting with the large flat teeth of Clypeaster, although at first sight in these small specimens it is frequently difficult, without an internal examination, to decide to which genus specimens belong,—a difficulty which soon disappears when the ambulacral rosette is better developed. On comparing these specimens from Florida carefully with Norwegian specimens of Echinocyamus pusillus I could detect no specific differences between them, and found that E. pusillus had, like our supposed young Clypeaster, the same peculiar structure of the poriferous zone. The outline varies from a pyriform to an elliptical one, more or less swollen, concave on actinal side; the pores are joined by very slight furrows; the ambulacra three times as broad as the interambulacra; the apical system large, though not distinct; in large specimens from six to seven pairs of pores to each petal. Anal system small, composed of four to five triangular plates. The spines of the lower part of test are more slender than those above ambitus, being frequently subulate when exposed to much wear. The color of spines of specimens when alive is greenish, frequently yellowish, or a mixture of the two.

Littoral to 325 fathoms.



ECHINANTHIDAE.

Subfamily **Echinanthidae** A. AGASS.

CLYPEASTER.

Clypeaster LAMK. 1816. An. s. Vert. (emend.)

The flat Clypeastroids are readily enough distinguished externally from their allies, yet their generic distinction would often be difficult, if not impossible, with such species as Echinanthus testudinarius from Australia, were it not for the flatter character of actinal surface, the less sunken mouth, and the better defined ambulacral grooves radiating from the actinostome. But the interior at once furnishes us a set of characters of great importance, in the absence of the double ambulacral chamber, and the slender needle-like pillars which replace the massive columns of the true Echinanthus. Actinal surface flat; actinostome sunken in a cavity of small extent, and well circumscribed, while in the other genus the cavity commences quite gradually.

Clypeaster subdepressus

† *Echinanthus* **subdepressus** GRAY, 1825. Ann. Phil.
† *Clypeaster subdepressus* AGASS. 1836. Prod.

Pl. XI[b]*; Pl. XI*[c]*. f. 1, 2; Pl. XII*[a]*. f. 4; Pl. XIII. f. 10–18.*

The only specific differences thus far noticed in the species of this genus are the character of the tuberculation, the position of the genital openings, and the comparative width of the median ambulacral space in the petals. The outline is elliptical, with slightly re-entering sides in the median interambulacral spaces. The greatest breadth is usually opposite the termination of the posterior pair of ambulacra; but in specimens in which the edge of the test becomes swollen, the greatest breadth is opposite the anterior pair of ambulacra (*Pl. XI*[c]*. f. 1, 2*). The test usually is nearly flat from the margin to the extremity of the ambulacral petals, then it commences to rise, and rises quite suddenly, arching regularly to the abactinal pole. The odd petal and the posterior pair have the same width of median ambulacral space; in the anterior pair this median space is narrower; they are also much shorter than other petals, though the posterior pair are longer than the odd anterior one. The genital openings are small, placed close to the madreporic body. The general outline of the petals is somewhat lanceolate, but this varies

greatly; the poriferous zone is narrow; the tubercles are small, uniform over the upper part of test; the miliaries are large, so that granulation appears quite homogeneous, the same granulation extending over the madreporic body. The spines over the whole of test are fine, short; the same generally on the lower surface, where, although the tubercles are slightly larger than on upper part of test, it is only immediately round the cavity where the mouth is placed that we find larger tubercles carrying longer spines. The ambulacral furrows are well marked from edge of test to actinostome, extending along the upper part of the test in the median and lateral sutures to the extremity of the rosette. The small anal system is at a short distance from the edge of the test on the lower side.

The color is yellowish-green from above, — when alive, somewhat lighter on lower side, where the sutures of the plates are a brilliant yellow, — the poriferous zone is a dark carmine, the edge of the test and the internal part of each plate of upper part of test is pinkish, surrounded by a yellowish border. The height of the test varies extremely; we find all possible stages between a highly arched test where ambulacral petals are placed, suddenly tapering, and a thin edge scarcely rising towards apex, so that the general aspect is that of an extremely flat Laganum when cursorily examined. A similar form of Clypeaster humilis is represented in the Pacific Ocean by the **Scutella latissima** of Lamarck, which is nothing but an extremely attenuated Clypeaster humilis. Agassiz distinctly says it is allied to C. scutiformis. This is an error, as it undoubtedly is a flat Clypeaster humile, although by mistake it was subsequently referred to Laganum in the Catalogue Raisonné. The variations in our common species are figured in the Plates; a specimen figured on *Pl. XII*[a]. *f. 4* is the young of the flat type, while on *Pl. XIII. f. 16–18* we have the young of the specimen with a thick swollen edge, high central test, to which I had given in the Preliminary Report the name of S. Ravenelli. A remarkably fine series of this form from Georgia, in the Museum of Liverpool, shows that the characters upon which I had distinguished it from C. subdepressus are only of secondary importance. The internal structure of edge of test is of course very different in the specimens with a thin edge or a swollen margin; in one case the pillars are few and broad, in the other they form quite a series of concentric lamellæ over a good portion of the interior of the test (*Pl. XII*[a]. *f. 4*).

The presence of a true Laganum in the West Indies has been often men-

tioned by various writers on Echinoderms, but it has invariably been presumed to be founded upon mistaken localities (Peronella decagonalis) or a confusion with young specimens of Clypeaster subdepressus. Mr. Pourtalès has dredged, from a depth of thirty-four fathoms, a small Clypeaster subdepressus of about two inches in length, which has the facies of a Laganum (*Pl. XIII. f. 16–18*) to such an extent that it would pass for one without an examination of the internal structure. The outline is pentagonal, with rounded corners; the pentagon is equilateral, and more regular than in any species of Laganum, the central part of the test rising abruptly from the extremity of the ambulacral rosette, which is not swollen. The petals are opened at the extremity. In this young specimen the lower surface is covered with spines only upon the interambulacral and a part of the ambulacral area, leaving broad, bare bands of the ambulacral areas colored light yellow, giving this specimen a striking appearance. The tubercles of the upper part of the test are quite small, closely crowded together; they increase in size in the interambulacral spaces of the lower surface. The color of the spines is greenish-yellow. The test has a thick, rounded edge, and it may be that specimens of this shape have been collected by those who have referred to the presence of a Laganum in the West India Islands. Hupé speaks of Laganum latissimum as found on the coast of Brazil. His specimen is nothing but the extremely flat variety of this species, of which I have also seen specimens from Cuba in the collection of Mr. R. Arango.

Lütken has given an excellent figure of young of this species (Bidrag. til. Kundskab om Echiniderne, *Pl. II. f. 2*). Mr. Pourtalès has dredged young specimens, one younger (in this youngest specimen the ambulacral rosette was already developed, *Pl. XIII. f. 10*) than the one figured by Lütken, and the other slightly older. The specimens can at once be recognized as young of C. subdepressus by their short ambulacral rosette and their sunken actinostomes. The comparatively thick rounded edge of these young specimens gives them a striking resemblance to Laganum. In the oldest of these, and in one measuring only a trifle over 51$^{mm.}$ in longitudinal diameter, collected at Charleston, we have already the general elongated outline of the adult, but the edge of the test is much thinner and the ambulacral rosette more closed than in the adult. The tubercles are scattered uniformly over the test, and we do not find, as in the younger specimens, along the edge of the test, larger tubercles in five or six irregular horizontal rows, giving to

the edge of the test of these young specimens a striking appearance (*Pl. XIII. f. 14*). We find frequently on the edge of the test of small specimens the glassy tubercles which are so characteristic of Echinoneus, but they do not appear to be constantly present, and furnish no additional clew as to their function. The great development which the pores of the ambulacral furrows take on the upper part of the test in small specimens is shown in *Pl. XIII. f. 12;* in young specimens the pores of the furrows are limited to the narrow line of the vertical and horizontal sutures of the plates, both on the lower and upper part of the test.

Littoral, — 34 fathoms.

Ant. Diam.	Diam. trans.	Height.	Length Post. Amb.	Width Median Petal.	Width Porifer. Zone.	Distance of Genital Pores.	Length Ant. Amb.
127	141	23.	44	12.	6.5	5.9	44.8
121	144	23.	38	14.	5.	5.	36.5
94	115	15.3	33	9.	3.8	3.1	26.
48	58	7.	4	4.1	2.		13.

The development of flat Clypeastroids of the type of Clyp. subdepressus is most instructive, tending to show that, in connection with the development of the Scutellidae hereafter described, we must probably introduce a complete reform among the genera recognized as Lenita, Scutellina, Runa, and other minute Echinoids, which may eventually prove to be nothing but the young of other Clypeastroids, such as Mellita, Scutella, Laganum, Clypeaster, Encope, and the like; but the want of sufficient material prevents me from entering into this comparison more in detail. Though we know now, from what I shall show below, that the Scutellidae pass through phases which cannot be distinguished from Moulinsia, Fibularia, Runa, Scutellina, and the Clypeastroids proper pass through a stage of growth similar to Echinocyamus. For similar reasons I am inclined to consider Fibularia as the early stage of some Clypeastroid. The absence of partitions in some species, I think, can easily be accounted for, as they are developed only later. We have a species of Fibularia from the Sandwich Islands, in which there are no partitions when very small, while in the adult these partitions are most rudimentary. Greater material than I possess is necessary to elucidate the affinity of the genus, which certainly has all the features of immature Clypeastroids.

Among the Clypeastroids, as well as among the regular Echini and Spatangoids, a large number of fossil genera have been discriminated which are based upon characters of no permanent value; differences which are not even specific among recent Echini, where we have had an opportunity of examining large series of various ages, having been so exaggerated as to become

of generic importance. This tendency is, however, not confined to the palæontologists alone, for recent writers on Echini, and myself among the number, have gone on subdividing genera till each species bids fair, if not to stand in a genus, certainly to occupy the dignified position of a subgenus. A glance at the material here brought together concerning a few species shows how far we have been going in the wrong direction, and I trust that, for certain groups at least, I have been able to show what direction we must give to our examinations of species to have them yield valuable results.

ECHINANTHUS.

Echinanthus Breyn. 1732. Schedias. (emend.)

Test thick, more or less elliptical or pentagonal. Ambulacral petals broad, often swollen, and limited by wide poriferous zones. Five genital pores, actinostome pentagonal, deeply sunken. Anal opening small, infra-marginal. Teeth placed vertically at extremity of jaws, each of which is supported upon two auricles. The interior is filled by pillars rising from the lower to upper floors; they are continuations of the double floors of the ambulacral and interambulacral chambers, so characteristic of the true Echinanthus, extending from mouth to apex. Johannes Müller, in his Bau d. Echinodermen, was the first to show the radical difference that existed in the internal structure of the flat and convex Clypeaster.

Müller has attempted to show that the madreporic body in the regular Echini determined the true position of the axis in the irregular Echini. In the figures he has given of the abactinal system of a number of species of irregular Echini, he has invariably found that it was the right anterior genital plate which was connected with the madreporic body, or the left posterior; and because we have Echinometrae in which the madreporic body is found either on the right or left of the imaginary longitudinal axis, he argues that it must be one of these posterior plates which is invariably the one to give us the position of the axis, and that it is not placing the irregular Echini in a homologous position with the other regular Echini, where the anus gives us the longitudinal diameter without any chance of error, to place the irregular Echini with the madreporic body in the symmetrical rear, with an ambulacrum opposite, as in the regular Echini. The madreporic body in the Scutellidae and Clypeastridae occupies the whole of the *central part;* it is regular in outline, usually star-shaped, and is not connected in any way

with the genital openings, which open in the interambulacral plates, its position would seem to show that in the irregular Echini, where the anal system is no longer enclosed by the abactinal system, the madreporic body can open anywhere, and become connected with either genital plate, as in the Spatangoids, either right anterior or right posterior, or several of them, including the left posterior, thus depriving it of the value which it has in defining the bearing of the axis of the regular Echini, where its position is fixed, while it is not fixed in the irregular Echini (*isolated in the Clypeastroids*, and may be connected with any one of the genital plates in the irregular Echini), where we find other features to guide us in placing correctly the axis of the animal.

Echinanthus rosaceus

! **Clypeaster** *rosaceus* LAMK. 1816. An. s. Vert.
! *Echinanthus rosaceus* GRAY, 1825. Ann. Phil.

Pl. XI^c.; XI^d. f. 1, 2; XI^f. f. 1–18; XIII. f. 9.

The characters by which most of the different species of Echinanthus have been separated thus far are totally inadequate. The majority of the large number of fossil species from the tertiaries have been distinguished on variations of the height, breadth, outline, the more or less open ambulacral petals, broader or narrower petals, — characters which the accompanying measurements of a series of specimens from Florida show to be found in any set of specimens from the same locality. The outline of this species is more or less elliptical, with convex posterior, lateral interambulacra convex. The test is usually moderately convex, varying in height from half to a third the length of the longitudinal diameter. The ambulacral petals occupy the greater part of the abactinal portion of the test, the madreporic body is central, pentagonal, crowded with small tubercles, the intervening space riddled with holes. The ocular plates joined to it are elliptical; the ocular openings large. The genital openings are large, opening in the median interambulacral space at some distance from the madreporic body. The median ambulacral space of ambulacral petals is broad, more than twice as broad as the poriferous zone, the furrows of which are distant, of uniform breadth for a considerable distance, and then diminishing rapidly towards the distal extremity, and more gradually towards the abactinal pole. The tubercles of upper part of test are remarkably uniform in size, sunken uniform miliaries completely filling the intervening space. The tubercles are more

closely set in the median part of the ambulacral petals than upon rest of test. This median part is frequently quite swollen, rising far above the general level of the test, so that the poriferous zone is regularly sloping from the edge of the zone to the interior row of pores; there the test rises suddenly, and is regularly arched over the remainder of the median ambulacral space. On the lower side, in old specimens, the mouth is deeply sunken, the cavity in which it is placed forming quite abruptly at about two thirds the distance from the edge of the test. The ambulacral furrows are very plainly defined, increasing rapidly in width a short distance from the edge of the test, and retaining a uniform breadth to the mouth. The tubercles of the lower side are much larger than those of upper part of test, placed closer, more deeply sunken, the miliaries surrounding them not so distinct. The anus is placed close to the edge of the test. The spines are short, of uniform size over the whole upper part of the test with the exception of the poriferous zone, where the average of the spines separating the ambulacral furrows is somewhat more slender. Those of the lower part of test are considerably stouter and longer than those of the upper part of the test.

The posterior ambulacral petals are the longest; the odd ambulacral one is slightly shorter, the anterior pair are considerably shorter; the median space of the odd petal is narrower than that of the other ambulacra, which are of uniform breadth.

The color of this species when alive is, from above, a beautiful reddish-brown; the median ambulacral region enclosed by the poriferous zone is more yellowish; the poriferous zone, of a darker reddish color, is a background upon which the flesh-colored lobed tentacles of the petaloid ambulacra are projected (*Pl. XI^f. f. 17, 18*). The whole upper part of test is also covered with minute flesh-colored water-tubes, capable of considerable expansion, passing through the small pores which riddle the whole of the test of these double-walled Clypeastroids.

Littoral to 5 fathoms.

Distance between Genital Pores.	Trans. Diam.	Long. Diam.	Height.	Length Post. Petals.	Width Porif. Zone.	Interpor. Median Post. Amb. Petal.	Interpor. Median Odd Ant. Ambul.	Length Odd Ant. Petal.
	38.	48.	13.	13.5	2.	5.4	5.	12.
	58.	71.	29.5	21.	3.	9.	8.	19.
	71.	97.	36.8	33.	4.1	15.3	12.5	29.1
7.3	92.	114.9	34.5	39.	5.6	17.	15.	34.
10.	102 5	124.5	60.	55.	5.5	21.	19.5	47.5
	86.	133.1	53.5	50.	6.	20.	19.	37.9
10.5	112.3	137.5	53.	53.2	7.5	20.5	17.2	41.

It is quite remarkable that of a species so common as this, only one young, small enough to show any very striking difference from the adult, should have been collected, while of nearly all the more common species complete series of all sizes were obtained.

This specimen is figured, natural size, on *Pl. XI^f. f. 1.* It is quite flat, the actinal surface is concave, but the test is not yet swollen; in fact, the edge of the test is only somewhat stouter than in some specimens of Clypeaster subdepressus. The rosette is much smaller, with a dark median ambulacral space, forming a prominent star, from the apical system; the sutures of all the plates are marked by similar dark bands, in both cases formed by minute spines closely crowded together. The primary spines are comparatively prominent, and are figured on *Pl. XI^f. f. 14.* They resemble already closely those of the adult. Younger stages are represented on *Pl. XI^f. f. 12, 13,* the latter being still attached to the test, while the spine (*f. 12*) has a distinct articulating surface. Over the greater part of the upper and lower part of the test are found pedicellariæ (*Pl. XI^f. f. 6, 10*); they are specially numerous in the small triangle at the edge of the test in the median ambulacra (*Pl. XI^f. f. 3*). These pedicellariæ are peculiar; nothing like them has as yet been described, except those of Pourtalesia, which resemble them. They consist (*Pl. XI^f. f. 6*) of a principal shaft, as stout and nearly as large as a primary spine, more transparent, terminating in a cup from which arises a comparatively slender muscle, urn-shaped, terminating in a huge tridactyle head of very remarkable structure, which terminates in three ball jaws; each jaw is broad at base, with from four to five roots, narrows rapidly to form a vertical shaft, terminating in a hollow semi-spherical head, edged with strong teeth (*Pl. XI^f. f. 8, 9*), which magnified appear like a very formidable weapon of attack. *Pl. XI^f. f. 7* is another view of a similar pedicellaria. A second kind is totally unlike this; the head is spherical, made up of thin half-shells articulated upon a long slender muscle and a slender shaft (*Pl. XI^f. f. 10*). The test when denuded (*Pl. XI^f. f. 4*) presents some striking differences from the adult. The primary tubercles are not sunken, but are raised above the general level, are comparatively few in number and large in size. The sutures are well defined by close granulation, the median ambulacral space being specially distinctly banded. In this stage the rosette is already developed (*Pl. XI^f. f. 4*), and from a denuded specimen would present no special points of difference, except in size, from an adult, with the exception of the absence of the genital plates, which are not yet developed, and the

structure of the tubercles in the median ambulacral space. When we examine the suckers coming from these pores, we find them totally unlike those of the adult Echinanthus (*Pl. XI'. f. 17, 18*). They are in every particular similar to those of the regular Echini, short, with a prominent well-marked sucker, as seen in *Pl. XI'. f. 2*, which represents a portion of the petaloid rosette, while the character of the gill-like suckers of the rosette of the adult is seen in *Pl. XI'. f. 17*. Each primary sucker is surrounded in the adult by small slender suckers, not differing from those found in young. The long sucker is lobed on both sides for half its outer length, and is pointed (*Pl. XI'. f. 18*). The pores, discovered by Müller in Clypeaster over the whole surface of the test, are already well developed in young specimens (*Pl. XI'. f. 16* represents a part of an ambulacral plate of the specimen figured in *Pl. XI'. f. 15*). These pores in young specimens carry regular tentacles with suckers, as is shown in *Pl. XI'. f. 3*, representing the edge of the test of the young specimen (*Pl. XI'. f. 1*) crowded with ambulacral suckers and pedicellariæ. The internal structure of Echinanthus is early developed (*Pl. XI'. f. 15*), specimens of the size of *Pl. XIII. f. 9* have already the commencement of the double floor on the edge of the test, and the pillars which separate the ambulacral system from the digestive cavity arise from the floor in sharp, numerous pillars. The changes the interior passes through correspond to those which Encope goes through, where the ambulacra in young stages are not isolated, resembling at one time those of Mellita, but afterwards the cellular structure of Encope completely isolates them; in Echinanthus the double partition early makes its appearance, though for a time the ambulacra are connected with the digestive cavity, resembling the permanent condition of Clypeaster proper; but at no time do we find in Echinanthus the peculiar arrangement of the ambulacral pores of the lower side in the sutures of the plates so prominent and striking a feature of Echinocyamus (*Pl. XIII. f. 2, 3*) and of Clypeaster proper (*Pl. XI'. f. 25*).

Numerous pigment cells, specially closely packed in the abactinal part of the median interambulacral space, indicate the commencement of the brilliant reddish-brown coloration so well developed in the adult.

SCUTELLIDAE.

Family **Scutellidae** AGASS. 1841. Mon. Scut. (emend.)

(SCUTELLA.) ECHINARACHNIUS.

Echinarachnius LESKE 1778. KLEIN Add.

Outline circular, test thick; ambulacral petals large, very distinct, open at extremity. Ambulacral furrows sending ramifications out only once near marginal extremity. Mouth central, anus marginal or rather supra-marginal. This genus differs externally from Scutella merely by the position of the anus and the mode of ramification of the ambulacral furrows of the actinal surface, — the median furrow, like that of Laganum, being preserved to the edge of the disk, — and it would perhaps be natural to consider it simply as a subgenus of Scutella, as proposed by Martens. An examination of the interior shows that it has the same arrangement of pillars as Dendraster and Scaphechinus. The mere eccentricity of the apex and the slightly different mode of branching in Dendraster do not entitle it to rank even as a subgenus of Scutella; in Echinarachnius, Dendraster, and Scaphechinus the pillars of the interior are more or less concentric with the edge (*Pl. XI^d. f. 4, 5*), while in Scutella they recall more the stellate arrangement of Mellita. The ambulacral notches of the posterior extremity of Scutella are more or less present in all the genera, so that externally Scaphechinus and Dendraster do not differ from Scutella, the position of the anus being of no value, while internally they show a somewhat different arrangement of the pillars of the edge of the test. For this reason I am inclined to consider Echinarachnius as a subgenus of Scutella; with it Dendraster and Scaphechinus will be merged as mere sections.

The jaws are high, supported upon feeble auricles, lobed in the centre; the teeth are not enamelled at the tip; the edges of the triangular base of the jaws form at their junction a prominent projection, formed of elliptical or circular cells, rising far above the level of the jaws, instead of the lamellar structure of the edge of the jaw existing in Clypeaster, Mellita, and Encope.

Echinarachnius parma

! **Scutella parma** LAM. 1816. An. s. Vert.
! *Echinarachnius parma* GRAY, 1825. An. Phil.

Pl. XI[d]. f. 4, 5; Pl. XI[e]. f. 4, 5; Pl. XII. f. 1–13.

As the measurements of the accompanying specimens of this species show, the variations in the outline, both from above and in profile, as well as the shape of the petals, are considerable. The outline from above may be either nearly circular or somewhat pointed anteriorly, or decidedly truncated posteriorly, with deep indentations for the anus and in the median ambulacral spaces. The profile may be regularly sloping from a nearly central apical system, with a thin edge of test, or we may have a thick edge of test, and an arching central part of the test from the outer edge of the petals. The position of the apex is also sometimes somewhat eccentric posteriorly, showing that this character alone cannot be of generic value, as had been taken for granted in Dendraster. The apical system is well marked, but differs considerably in specimens of the same size; the rosette is generally open at the extremity in flat specimens, while in more arched ones the petals have a decided tendency to converge at the outer end; the poriferous zone is narrow, not more than from one quarter to one fifth the width of the ambulacra. The marginal ramifications of the ambulacral furrows are frequently quite indistinct in older specimens. The tubercles are closely surrounded by miliaries, covering the whole upper part of the test, including the apical system, with a fine homogeneous granulation. On the lower surface near the actinostome the tubercles are distant; they become, however, closely packed at the commencement of the ramifications of the ambulacral furrows, although there is no miliary granulation on the lower surface so characteristic of the upper part of the test. The spines of the lower surface are larger, longer, and of variable length, those covering the opening of the actinostome are the largest, while the spines of the upper surface are shorter, and of uniform size. The color when alive is a beautiful crimson-carmine, tending to greenish, or of intermediate shades; lower surface of the same color; ambulacral furrows darker.

The range of this species is quite astonishing, and its association on the Asiatic coast with a second well-marked species has undoubtedly caused a great deal of confusion, in addition to the presence of Arachnoides, which, when covered by spines, might readily pass as either of the species of true Echinarachnius. I am unable, upon examination of the originals, to dis-

tinguish the species established by Michelin and Gray, based upon slight local differences, such as the outline of the test from above or in profile, the more or less open petaloid ambulacra, the distinctness of the branches of the ambulacral furrows, which are all features subject to great variation in specimens from the same locality. The length of the petals is very variable, in some specimens not extending beyond half-way from apex to margin, while in others they reach fully two thirds of the distance. There are two principal branches of the ambulacral furrows, commencing from two thirds the distance of the mouth to the edge of the test.

Littoral to 40 fathoms.

Height.	Lat. Diam.	Anal Diam.	Length Ant. Amb.	Width Med. Inter. Porif. Amb.
11.	73.	71.	20.	5.1
13.2	62.9	61.	20.1	8.
7.1	55.3	52.	15.2	4.7
9.	51.5	49 2	14.	3.1
10.5	46.3	46.	15.	5.9

Young specimens of Echinarachnius parma, measuring from 2.1$^{mm.}$ to 6.2$^{mm.}$ in diameter, are readily found in the stomach of our cod. The outline of the youngest specimen observed is elliptical (*Pl. XII. f. 1*). The test is high, arched, resembling somewhat a Cassidulus from the position of the anus (*Pl. XII. f. 3*), and an Echinometra from the vertical rows of large tubercles, one for each ambulacral and interambulacral plate, forming regularly decreasing rows from the apex to the mouth. The lower surface is nearly flat, the actinostome is large, pentagonal (*Pl. XII. f. 2*), being fully one third the diameter of the test across the opening. There are but slight traces here and there of miliaries; the tubercles are so closely crowded that it is impossible, beyond the presence of five pairs of pores, one pair for each ambulacrum, to detect any further trace of the ambulacral pores, although it is easy to identify the ambulacral rows. The vent is placed a short distance above the ambitus (*Pl. XII. f. 3*), no trace of the poriferous zone could be seen near the mouth. The rotules are present in shape of a peculiar spine, which is most prominent in specimens measuring about 4.$^{mm.}$ in longitudinal diameter. In a somewhat older specimen the difference of outline is very striking; it is pear-shaped (*Pl. XII. f. 4*), the blunt end being the posterior; the test is still considerably arched, but has become a good deal flattened when compared to the previous stage. We find also the commencement of the difference in the arrangement of the ambulacral and interambulacral plates, due to the different rate of growth of the two areas. The mouth is

comparatively much smaller, the lower surface has become much flattened, the mouth being sunk, and edges of the test raised. There are quite distinct ambulacral pores, two for each side of the odd ambulacrum, and two and three on each side of the other ambulacra. The pairs of pores are pierced between the plates, and are not connected by furrows. Each plate (ambulacral and interambulacral) of the test carries as yet but one large primary tubercle; the rest of the plate is thickly crowded with miliaries. In a somewhat more advanced stage there was a marked difference in size between the upper pairs of pores, forming an extremely rudimentary rosette (*Pl. XII. f. 5*) of independent pairs of pores not confluent and not joined by furrows, additional pores, pierced through the plates, extending towards the ambitus in continuation of the poriferous zone. The larger pores simply radiate fanlike from the apex; there are four pairs in the odd ambulacrum, three and five in the anterior pair, and four and five in the posterior ambulacra. The miliaries of the plates of test surrounding the main tubercle are larger, and the sutures of the plates more distinctly brought out than in the previous stage. The position of the anus is nearer the ambitus, and when seen from the lower side (*Pl. XII. f. 6*), the young Echinarachnius has the same undulating concavity so characteristic of Pygaster and allied genera. The outline of this specimen was also somewhat less pear-shaped, and flatter. In an older specimen, measuring about 5.1$^{mm.}$ in length (*Pl. XII. f. 9*), the test had become quite flattened, the mouth was slightly sunken below the raised edge of the ambitus, the outline more pentagonal, the vent placed nearer the edge, and we have the first appearance of pores arranged so as to form a distinct rosette, connected by furrows in the part of the rosette nearest the middle. As in the preceding stage, there are additional pairs of pores pierced between the ambulacral plates extending towards the ambitus in continuation of the rosette. Each plate now carries from three to six primary tubercles, according to its size, thickly crowded round with miliaries. The anal opening is closed by a single plate (*Pl. XII. f. 11*); the madreporic body is quite distinct, and very minute pores can be traced in the indistinct ambulacral furrows of the lower side. In specimens measuring 6.$^{mm.}$ the rosette is more prominent (*Pl. XII. f. 10*), the pores being all connected by furrows; the plates of the test are uniformly covered by primary and miliary tubercles, the sutures of the plates are less distinct, and four small additional anal plates have appeared (*Pl. XII. f. 12*) at the marginal edge of the anal opening. In still larger specimens, measuring

about 15.mm. in diameter, the ambulacral rosette has all the features of the adult (*Pl. XII. f. 13*), the grooves uniting the pores are deep, the madreporic body is fully developed, the tubercles are uniformly distributed, the vent closed by six plates (*Pl. XII. f. 12*), the first plate being still by far the largest, — at this stage the difference in the rate of growth between the ambulacral and interambulacral plates becomes quite as striking as in the corresponding stages of Encope. There seems to be no ratio between the number of ambulacral and interambulacral plates, as the older the specimen the greater seems to be the number of ambulacral plates in comparison with the interambulacral plates; when measuring 15.mm. to 16.mm. in diameter, the young Echinarachnius has the general outline of larger specimens, and except its size has, as far as I can see, no further distinguishing features.

MELLITA.

Mellita KLEIN, 1734. Nat. Disp. Ech.

Test exceedingly flat. Ambulacral petals closed, remarkably well defined, five or six elongated lunules in the prolongation of the ambulacral petals; when five are present the odd anterior ambulacral one is wanting, the posterior lunule is situated in the interambulacral space. The ambulacral grooves of the actinal surface are very ramified and undulating. Pillars, in the interambulacral areas, separate the buccal from the digestive cavity. The tubercles of the interambulacra of the lower side are very large, comparatively, between the ambulacral grooves, and small adjoining them. The spines corresponding to the different sizes of tubercles are either long and tapering or short and club-shaped, while larger flat-shaped spines surround the lunules on the upper side. The spines of the upper surface of test are all club-shaped, those edging the lunules more or less spathiform; those of the ambulacral furrows and its branches are curved, and those of the large tubercles of the lower surface straight and elongate. Four genital openings; madreporic body occupying central apical part of test. The anus is at the proximal extremity of the interambulacral lunule, close to the mouth; outline of test circular, truncated posteriorly.

Mellita sexforis

Echinodiscus **sexiesperforatus** LESKE, 1778. KLEIN, Add.
! *Mellita sexforis* A. AGASS. 1872. Rev. Ech. Pt. I.

Pl. XI. f. 1–12; Pl. XI[a]. f. 3.

Five ambulacral lunules and one posterior interambulacral one. The apex and the mouth are central, or nearly so, while in the pentaphorous species of Mellita they are quite eccentric. The ambulacral lunules are of the same size, narrow, elongate, while the odd posterior lunule is usually somewhat smaller than the others. The test in all the specimens examined slopes regularly from the apex towards the edge. The outline is more or less circular or pentagonal, but slightly truncated posteriorly. The ambulacral petals are all of the same size, comparatively small, not reaching half-way to the edge of test from the apex. The median ambulacral space, included between the poriferous zones, is as broad as each zone; genital openings distant from apex. The coronal plates of upper part of test are all more or less convex.

The ambulacral furrows ramify more at the extremity near the edge of the test, on each side of the lunules, than in the other species, leaving but a very narrow median interambulacral space not covered by furrows. The large tubercles of the lower surface are consequently fewer in number; they are, at the same time, more uniform in size where they occur; the rest of the lower surface of the test is covered by fine granulation of smaller tubercles near the poriferous furrows. The difference in size between the spines of the two surfaces is slight, their arrangement is the same, there are but few comparatively large spines immediately round the mouth, the whole lower surface being covered by silk-like spines not clavate, like those of the upper part of the test. The color when alive is slightly yellowish, ranging through all the shades of a dirty yellow to a light olive-green. The bathymetrical range of this species is quite extensive (littoral – 270 fathoms), though the geographical range, as far as we know it, is not great, being confined to the West Indies and to the Bermudas.

Young specimens of Mellita sexforis, measuring 2.4[mm.] in diameter (*Pl. XI. f. 1*), are almost circular, with a thickened raised edge as in Laganum, and as yet have no lunules visible from the abactinal side. The rosette is simply a series of radiating pores, three and two in each poriferous zone, for each ambulacrum, extending but a short distance from the apex, having the simple structure of the poriferous zone of non-conjugated pores of Echinocyamus. The ambulacral and interambulacral plates are

of the same size, hexagonal, forming twenty equal zones (*Pl. XI. f. 1*), carrying but a single large tubercle in the centre of each plate; seen from below the surface is deeply concave (*Pl. XI. f. 2*), the mouth much larger in proportion to the test than in adult specimens, and we see forming from this side the posterior interambulacral lunule as a deep pit, at one extremity of which is placed the anus near the mouth, about one third the distance from the edge of the test, as is seen in *Pl. XI. f. 6*, representing the posterior lunule of a specimen somewhat older; the rotulæ are already well developed in specimens of this size (*Pl. XI. f. 5*).

The outline in a subsequent stage becomes slightly pear-shaped (*Pl. XI. f. 3*), the plates elongate; the lunule pierces through to the abactinal side; the rosette is still made up of radiating pores, consisting of five to six pairs of pores for each poriferous zone. The ambulacral area is now slightly narrower than the interambulacral zones, though the plates carry as yet but a single primary tubercle. Seen from below (*Pl. XI. f. 4*), we find rudimentary phyllodes made up of a few of the small pores, which eventually extend in the ambulacral furrows to the edge of the test, but are now restricted to a small number clustered round the mouth (*Pl. XI. f. 4*), entirely similar to those of older specimens, as seen in *Pl. XI. f. 20*, though restricted in extent. When the posterior lunule has become a small round opening (*Pl. XI. f. 7*), encroaching upon the plates of the posterior interambulacral area, which extends as a very faint lobe beyond the outline of the test, the rosette becomes slightly pentaloid. There are now from two to five tubercles on each plate (*Pl. XI. f. 7*); the plates are quite elongate, having lost their hexagonal outline; the lower surface is flat, and on the lower side (*Pl. XI. f. 8*) the ambulacra have broadened very rapidly, the interambulacra forming narrow bands carrying larger tubercles between the ambulacral zones, showing already in a very marked manner the difference, so prominent in older specimens, in the character of the ambulacral and interambulacral areas of the actinal side. The edge of the test is still quite thickened (*Pl. XI. f. 7*), and it is only when the young Mellita has attained somewhat less than half an inch in diameter that the ambulacral lunules appear as pits, seen at first from the lower side only, and gradually forcing their way through the test. The posterior interambulacral lunule increases rapidly in size; the lunule and the groove in which the anus is placed become somewhat separated, being simply a depression in the continuation of the lunule. After the appearance of the lunules as slight pits, which develop unequally

(*Pl. XI. f. 10*), not appearing simultaneously, the changes are limited to the increase in size of the lunules (*Pl. XI. f. 11*), and of the poriferous ambulacral zone on the lower side; the outline and general facies, with the exception of the larger size of the tubercles, being that of the adult (*Pl. XI. f. 12*).

Contrary to what was to be expected from analogy, we find in Mellita Stokesii, so closely allied to Mellita sexforis, the lunules developed as cuts along the periphery, exactly as in Encope, and in the two other species of Mellita, so that the mode of development of the lunules does not seem to have any great physiological value, whether formed by the resorption of the test in the centre of the plates, or by a retardation of their growth at the edge of the test; those species which are most closely allied having diametrically opposite modes of development of the lunules. In fact, the mode of development of Encope and of Mellita testudinata (and M. longifissa) is far more closely allied than that of the two species of Mellita of the types of sexforis and Stokesii.

Mellita testudinata

! **Mellita testudinata** KLEIN, 1734. Nat. Disp. Echin.

Pl. XI. f. 13–22; Pl. XII^a.; Pl. XII^c. f. 1, 2.

Four lateral ambulacral lunules, in continuation of the median line of ambulacra, and one posterior interambulacral one; outline more or less rounded anteriorly, truncated posteriorly, greatest width usually across the lateral posterior interambulacral space; the organic apex is slightly eccentric anteriorly, the test sloping gradually towards the posterior edge, but curved towards the anterior edge, which is usually thicker, though we find frequently specimens in which the slope is the same towards both edges; the lunules are all narrow, elongate, the interambulacral one being the largest. The petals are of nearly uniform size, the odd and anterior pair slightly shorter than the posterior pair. Each poriferous zone is broader than the enclosed median ambulacral space; the poriferous furrows are separated by a single row of tubercles very regularly arranged in a line parallel to the furrows. The tubercles covering the upper surface of the test are extremely uniform in size (except those on the edge of the lunules); they are closely packed, and separated by ridges of minute miliary tubercles. The large tubercles which cover the interambulacral space of the lower side have no regular arrangement, any more than those of the upper part of the test; they are small near the edge of the test, and closely crowded, but

gradually increase in size and become more widely separated, especially near the actinostome from a distance of one quarter of the radius, where they are quite distant. The ambulacral furrows, sending out a principal branch on each side of the median ambulacral space, send out short processes over the whole lower surface, and longer ones near the edge of the test; they diminish considerably in number and distinctness upon the interambulacral spaces, especially the posterior space. The median ambulacral zone carries large tubercles, but they disappear near the branches of the poriferous zones, leaving a considerable distance on each side of them apparently bare, but covered in reality with very minute tubercles carrying diminutive spines. The arrangement of the spines on the lower side in the two species of Mellita is peculiar; the large spines of the anterior interambulacral spaces are directed outward, those of the posterior interambulacra are turned inwards. On the upper part of the test the spines all turn towards the periphery. The color when alive is a greenish-blue.

The general character of the changes undergone by Mellita sexforis, as far as they relate to the transformations of the ambulacral rosette, the growth of the tubercles, the changes in the proportions of the relative breadth of the ambulacral and interambulacral zones, is identical in Mellita testudinata and M. longifissa. What is remarkable in Mellita testudinata is that the mode of formation of the ambulacral lunules is not identical with that of M. sexforis. The interambulacral lunule alone is developed from a depression formed on the lower surface pushing its way through the test, while the ambulacral lunules are the result of the closing in of notches appearing on the edge of the test, which remain open until the young Mellita has attained a considerable size, — three quarters of an inch and sometimes more; long after the arrangement of the plates, the shape of the rosette, the size of the tubercles, and the extent of the poriferous zone on the lower surface have the character of the adult.

The smallest specimens of Mellita observed, measuring about 3.6^{mm} in diameter, are nearly circular; they have at this stage but a single lunule, the posterior interambulacral one, scarcely perceptible from above, but from the lower side well seen as a deep conical pit pushing its way gradually more and more towards the abactinal side, and becoming larger and larger when seen from that side with increasing age; when it has attained a diameter of about 8.^{mm}, the centre of the ambulacral edge of the test becomes slightly indented, — the first trace of the ambulacral lunules

(*Pl. XI. f. 13*). The posterior ambulacral lunules (notches) are the first to be developed, the young Mellita having at this stage (excluding the posterior interambulacral lunule) somewhat the shape of a diminutive Echinodiscus, or Encope Michelini, and as the cuts increase in depth with advancing age (*Pl. XI. f. 19*) resemble in a remarkable degree a small Encope grandis. The commencement of the closing process of the notches is shown in drawings of M. longifissa (*Pl. XI. f. 24, 25*), while in *f. 26, 27*, of the same Plate, the lunules are completely closed.

The large series collected by the Thayer Expedition along the whole coast of Brazil shows that this species has a wide geographical range, and is liable to great variations, indicating that the characters which have been described as separating M. quinquefora and M. testudinata have no permanent value.

Littoral to 7 fathoms.

ENCOPE.

Encope AGASS. 1840. Cat. Syst. Ectyp.

Contains species of considerable size; actinal surface flat, abactinal more or less regularly arched; always having in the prolongation of the ambulacral petals either lunules or indentations, which vary extremely according to age, and in different individuals of the same species. There are five genital openings, while there are only four in Mellita. The ambulacral petals are very unequal in size, the posterior pair usually larger than the anterior ones. Ambulacral furrows greatly ramified. The main difference between this genus and Mellita consists in the continuous calcareous partition which separates the buccal from the digestive cavity, in place of the disconnected pillars of Mellita. Outline elliptical, truncated posteriorly. In addition, we have in Encope a horizontal floor separating the buccal cavity from the upper part of the test, in which the ambulacral system is confined, while in Mellita the ambulacral petals open directly into the main cavity above the buccal orifice.

Encope emarginata

Echinodiscus **emarginatus** LESKE, 1778. KL. Add.
! *Encope emarginata* AGASS. 1841. Mon. Scut.

Pl. XII. f. 14–24; Pl. XII^b. f. 1–3; Pl. XII^d. f. 2–3.

As the accompanying measurements show, it is difficult to define the outline of this species, its variations including all possible forms between a more or less pentagonal outline with the deep cuts (lunules) at the angles of the pentagon, and a subcircular outline anteriorly, retaining only one side of the pentagon posteriorly. Seen from above, denuded of spines, the whole test is covered by remarkably uniform tubercles closely packed with extremely diminutive miliaries, the same granulation extending over the ambulacra, both the poriferous zone and the median part of the rosette; only on the edge of the lunules do we find somewhat larger tubercles. As in other Scutellidae, the median interambulacral spaces are covered by larger tubercles, as well as the rest of the lower surface, except in the proximity of the ambulacral furrows and their branches, which form broad avenues covered by small miliaries. In the typical E. emarginata the lunules are more or less elliptical, and usually their edges at least touch, if they are not completely closed; the odd interambulacral lunule is nearly twice as long as any of the others; the edge of the test in such specimens is thin, and the outline in profile is gradually sloping from the vertex to the ambitus. The vertex is eccentric anteriorly, and corresponds usually also with the apex; but it is not unfrequent that the anterior edge of the posterior lunule is slightly higher, especially if the lip of the lunule is well developed, as in the case of what has been called Encope oblonga, where the lunules are completely closed, and the edge of the test and of the lunules is thick, the outline being at the same time somewhat circular. When the lunules remain wide open, and the general outline of the test is pentagonal, it has received the name of E. Valenciennesii, but there are no features by which it can be separated specifically; though there is a species on the west coast of America having very much the same general outline (E. grandis), which has, however, such remarkable internal structure that there are excellent grounds for maintaining that species.

In specimens measuring 13.$^{mm.}$ in diameter, the ambulacra are not yet separated from the digestive cavity by the complete wall of spongy calcareous mass so prominent in old specimens. In these and young specimens simple pillars connect at first the two floors, as in Mellita and Echinodiscus.

Pl. XII^{b}. *f. 2* shows the extent to which the ambulacra are isolated from the remainder of the digestive cavity in fully grown specimens. The jaws are quite small (*Pl. XII*^{b}. *f. 3*), and the calcareous cellular work connecting the two floors leaves a comparatively small space for the winding of the alimentary canal, which becomes quite narrow and small by the time it reaches the anal opening.

Among the specimens dredged from considerable depth were a number of Encope emarginata of various sizes, from half an inch in longitudinal diameter to an inch. These, in addition to a large series of young of the same species sent from Desterro by Dr. Fritz Müller, present some interesting structural points, and have also, not unexpectedly, however, led to the conclusion that Moulinsia was nothing but a young Encope. Dr. Lütken, in speaking of the chance of young Encope being a Moulinsia, seemed to consider the scalloped edge as a most distinguishing feature. The same feature is also quite prominent in young Mellita, but they are always more circular, and do not assume the elongated form which is so characteristic of Moulinsia. This scalloped edge is not most prominent in the youngest specimens; it is most striking when they are from 6.^{mm} to 8.^{mm} in diameter, previous to the appearance of the lunules on the dorsal side, when, as I think, the figures will show plainly they have all the appearance of Moulinsa (*Pl. XII. f. 14, 15.*). There are some points in the structure of the young specimens of the size figured by Lütken, to which it may be worth while calling attention. Lütken has noticed that there was a striking difference in Mellita and Encope in the modes of formation of the ambulacral lunules. In Encope they are formed by the closing in of notches made by the prolongation of the plates, which often remain open during the whole life, while in Mellita (M. sexforis) the ambulacral lunules are formed by pits in the test itself. I have noticed that these pits (lunules) appear at first on the lower surface, and little by little force their way through the test (see Mellita sexforis); the posterior interambulacral lunule in Mellita is formed in the same way, and the same is the case in Encope, where I have observed it in the youngest Encope (a specimen from Desterro, sent by Dr. Fritz Müller) in the condition of a Moulinsia, when the lunule was a very marked pit on the lower surface alone (*Pl. XII. f. 15*), not yet having forced its way through the test to the dorsal side, which had a smooth unbroken posterior interambulacral dorsal area (*Pl. XII. f. 14*). The anus opens directly in the centripetal extremity of the lunule, while in the adult the lunule and the

anal opening are separate, the latter being placed at a considerable distance from it toward the mouth. As the specimens become older there is a tendency to separate, the anus being placed in a groove which is a shallow continuation of the lunule, approaching more and more the mouth, till, in specimens measuring 37.$^{mm.}$ in diameter, the anus is completely separated from the lunules (see *Pl. XII. f. 18, 21, 23, 25*). The shifting position of the anus depending upon entirely individual circumstances, shows that its position cannot be used as a specific character. The youngest Encope I have had occasion to examine shows already traces of the two posterior ambulacral notches (*Pl. XII. f. 14, 15*), but they are so slight that they would most likely be overlooked, especially in specimens somewhat more advanced, when the scalloping is more prominent (as in the figures of Moulinsia of Agassiz in his Monographie des Scutelles), in fact, the cuts of the edges being fully as deep as the notches. These divide the edge of the test into twenty well-marked scallops, the ambitus is elliptical, the apex central, and in this condition the ambulacral and interambulacral plates both diminish gradually in size towards the centre, forming twenty sharply defined ridges, the sutures between the plates running to the apex from the edge of the test being well marked by the absence of granulation. Each ambulacral and interambulacral plate carries from one to two, or at most (near ambitus) three, primary tubercles, the rest of the plate being covered by miliaries. There is no ambulacral rosette, but two pairs of pores; one pair, between adjoining ambulacral plates, extend in each poriferous zone from the apex to the ambitus, there being in the present stage only as many ambulacral as interambulacral plates (*Pl. XII. f. 14*), seven from ambitus to apex. There is a faint trace, even at this early stage, of a madreporic body, but no genital openings are as yet formed. The pairs of pores are not yet connected by a furrow, but are simple holes. The furrows formed by the sutures of the plates are not as deeply cut on the lower surface, those of the median ambulacrum being most prominent; the position of the poriferous furrows is indicated by minute pores irregularly scattered, while towards the mouth at the base of the furrows the pores are quite large, forming almost an imitation phyllode. The rotules, on each side of which start the lines of pores, are already apparent. The lower surface is concave, the edge being slightly raised; the outline seen in profile is somewhat more convex than in older Encope, but the difference bears no comparison to the difference noticed in young Echinarachnius.

In older specimens, where the posterior interambulacral lunule has just forced its way to the dorsal portion of the test (*Pl. XII. f. 17*), the abactinal part of the ambulacra is petaloid, the last two pairs of pores alone are not connected by furrows, and are pierced between two adjoining ambulacral plates, while the other pairs, fourteen in number, are joined by furrows. These fourteen plates correspond to four interambulacral plates, showing a different rate of growth between the plates of the interambulacral and ambulacral series. The sutures between the various ambulacral plates have become obliterated, there are a large number of tubercles on each plate, and the general aspect of the upper surface begins to resemble more closely that of the adult. The madreporic body is well developed, no genital openings yet. The pores on the lower surface are particularly numerous round the actinostome, forming ten points, somewhat like phyllodes (*Pl. XII. f. 18*), having their origin on each side of the rotules. In a somewhat more advanced stage the lines of pores are connected at their base, and fork at a short distance from the mouth (*Pl. XII. f. 21*). The interambulacral plates on the lower surface are covered by larger tubercles than the others, making five narrow zones, in contrast with the ambulacral region, where the tubercles are very minute.

The outline of the young stages of Encope (*Pl. XII. f. 20–24*) before the closing of the lunules, while they are still mere indentations, recalls strongly the post-pliocene form Monophora, and some of the other species of Encope found on the west coast of Florida and the Gulf of California, E Michelini and E. grandis.

Dr. Lütken, in his discussion of Encope emarginata, has given figures of young Encope after the appearance of the posterior interambulacral lunule.

The madreporic body is large, quite markedly stelliform, the ocular plates often rising as sharp ends from its sides, the genital openings are large and placed at a considerable distance from the centre of the madreporic body within the median interambulacral space. The posterior pair of ambulacral petals are longer than the others, the odd petal somewhat shorter, and the anterior pair of ambulacra intermediate in length. The poriferous zone has about the same width in all the petals, but the median ambulacral space of the posterior ambulacra is quite narrow compared to the others, the poriferous zone being broader than this median space in the posterior ambulacra. The posterior lunule extends to within one quarter the distance of the mouth from the edge of the test, the anus is placed quite near the mouth

in the commencement of the depression of the lunule. The color when alive is dark olive-green.

The difference in the width of the median ambulacral spaces is scarcely marked in young specimens, as is seen by the measurements; the posterior lunule also is frequently enclosed by the posterior ambulacra in large specimens, while in small specimens it is frequently entirely outside the extremity of the petals. The ambulacral petals become more and more different in length with increasing size; the difference of the median ambulacral spaces is but little perceptible in young specimens.

Height.	Trans. Diam.	Ant. Diam.	Post. Pair Ambul.	Ant. Pair Amb.	Interpor. Post. Amb.	Interpor. Ant. Amb.	Width Porif. Zone Ant. Amb.	Post. Lunule.
14.2	115.	122.	34.5	28.	4.	5.8	6.2	29.
13.5	113.	120.	34.	24.9	6.	6.3	6.	31.
13.	99.	98.	26.	19.	4.1	5.9	5.9	24.8
7.	79.8	80.5	20.5	15.5	3.	4.	3.	15.3
5.	62.	61.2	14.	10.	2.	2.9	2.4	11.2
3.4	48.1	45.	10.5	8.	1.8	2.	1.8	7.
3.5	38.	38.	8.	7.5	1.2	1.2	1.2	6.5
16.5	140.	121.	45.	33.	4.		7.5	44.

Littoral — 7 fathoms.

Encope Michelini

! *Encope* **Michelini** AGASS. 1841. Mon. Scut.

Pl. XII^{b}. *f. 4; Pl. XII*^{c}. *f. 3, 4; Pl. XII*^{d}. *f. 1.*

The extensive suite of Encopidae brought home by the Thayer Expedition from different points of Brazil, and more particularly the series of all sizes of Encope emarginata which the Museum owes to the kindness of Dr. Fritz Müller, of Desterro, has satisfied me that Lütken is correct in uniting under one name, that of E. emarginata, most of the nominal species he mentions (E. Valenciennesii, subclausa, oblonga, E. quinqueloba), to which we would add the name given by Belval, *E.* **Ghiesbrechtii**. Yet I cannot agree with him in referring to the same species Encope Michelini, in which the position of the apex is totally different from that of any of the other species referred to E. emarginata, as is readily seen by the excellent profile given in Agassiz, Mon. d. Scut., *Pl. VI*^{a}. *f. 10.* Nor can I agree with him in referring E. grandis to Encope emarginata, a species found in the Gulf of California, and Encope Agassizii, identical with it. There is a second species also found on the West Coast, which Verrill has described as *E.* **occidentalis**, and which is identical with *Encope tetrapora* AG. non GMEL. From a careful comparison of specimens of E. cyclopora, micropora, and perspectiva, there is no doubt that these

are only nominal species, all identical with E. occidentalis; and as the name "micropora" seems to be the most appropriate, besides being the oldest, it would be the best name to retain. A careful statement of the points of difference between E. micropora and E. emarginata will be found in the description of the Panama species, in the general descriptive part of the species.

This species is readily distinguished from E. emarginata by the position of the vertex, which is directly in front of the small posterior lunule, and is not due, as is sometimes the case, to the swelling of the lip of the lunule, but to a rise in the test itself. The outline resembles, at first glance, more that of E. grandis, but it is more pentagonal; the lunules are frequently closed, and when closed become obliterated exteriorly in old specimens; the small size of the posterior interambulacral lunule is striking, scarcely as large as the marginal lunules; the three anterior lunules are frequently mere indentations in the margin, giving to the general outline very much the appearance of Echinodiscus with an interambulacral lunule (*Pl. XII*^{c}. *f. 3*). The vertex as well as the mouth is nearly central; the anus is placed about one third the distance from the mouth to the edge of the test. The tubercles are more closely packed than on the upper part of the test of E. emarginata, while the spaces filled with larger tubercles between the bare avenues adjoining the ambulacral furrows of the lower side are narrow, and the tubercles smaller than in the preceding species. It is, however, on examining the interior (*Pl. XII*^{b}. *f. 4*), that we are at once struck with the remarkable differences to be noticed between these two species. The size of the jaws, the narrow marginal band connecting the two floors, the great size of the cavity occupied by the alimentary canal, the width of the alimentary canal, and the size of the walls separating its different convolutions, contrast strikingly with the small jaws, the narrow convolutions of the alimentary canal, and the great breadth of the marginal band connecting the upper and lower floors of E. emarginata (*Pl. XII*^{b}. *f. 3*).

Height.	Transverse Diam.	Long. Diam.	Length Post. Pair Amb.	Length Ant. Pair Amb.	Width Interporif. Post. Amb.	Width Interporif. Ant. Pair Amb.	Length Post. Lunule.	Width Porif. Zone Post. Pair Ambul.
18.	125.	128	50.4	36.2	3.2	5.4	13	7.9
16.8	110.5	106	39.9	31.9	4.2	5.6	16	6.
11.	94.	84	20.5	23.	3.	5.	13	4.

Littoral to 11 fathoms.

PETALOSTICHA.

Suborder **Petalosticha** HAECKEL, 1866. Generelle Morphol. (emend.)

Among Spatangoids proper, the examination of young specimens shows that they undergo great changes in outline during their growth; the posterior part of the test is especially subject to variation, the position of the anus is exceedingly variable in one and the same species, the mouth is not labiate in the young as in the adult, the peripetalous and lateral fascioles do not change in their limits, but the subanal and anal fascioles are liable to great modifications during their growth, and cannot be used as distinguishing features of generic value, while the permanence of the peripetalous and lateral fascioles is of great systematic value. The ambulacral petaloids also are greatly modified with age, generally becoming confluent, while in the young they are remarkably distinct, and the pores not conjugated.

Lovén has already called attention to some of the most striking peculiarities of Spatangus purpureus when young. To show the extreme care which must be taken in our determination of genera among Spatangoids, I have introduced figures of a small Spatangus purpureus (*Pl. XI^f. f. 19–22*), which is remarkable for its globular shape, but particularly interesting on account of the structure of the abactinal part of the ambulacra (*Pl. XI^f. f. 19*). The pores are as yet simple, not conjugate, resembling in every particular the simple pores of young Cassidulidae and of regular Echinidae, no trace as yet being seen of the petaloid structure of this part of the ambulacra. The ambulacra are in this young Spatangus identical in structure with those of Holaster, and of other genera of Ananchytidae.

The Cassiduloid-shaped mouth of young Spatangoids, as well as the existence of several Spatangoids, both fossil and recent, in which the mouth has a similar structure, is a convincing proof of the correctness of uniting Cassiduloids and Spatangoids in the same suborder, though the name given to them by Albin Gras, of "Irregular," is hardly what could be desired.

The great number of Spatangoid genera established upon differences in the subanal fasciole, the existence or absence of the anal branch, the depth of the ambulacral grooves, the confluence or distinctness of the lateral am-

bulacra, all based upon characters subject to great variation during growth, show the necessity of a careful revision of the whole group of Spatangoids, especially of the fossil genera, with the data here furnished, before we can attempt an arrangement of Spatangoids into natural families.

CASSIDULIDAE.

Family Cassidulidae AGASS. 1847. C. R. Ann. Sc. Nat. VII. 147.

ECHINONIDAE.

Subfamily Echinonidae AGASS. 1847. C. R. Ann. Sc. Nat. VII. 147.

The close structural resemblance between the young of Echinolampadae and Echinonëus shows that Echinonëus has no affinity whatever with the Galeritidae, with which the genus has always been associated, but that it is a true embryonic Cassidulus allied to Echinolampadae and Caratomus, already suggested by Desor to be a true Cassidulus, and not a Galerites. This affinity the examination of young Echinolampadae proves undoubtedly. The removal of Echinonëus, Caratomus, and all the allied edentate forms of Galerites, now reduces the family to one of great homogeneity, and suggests again the question of their affinity to true, regular Echinoids in a more forcible manner than before. We must, however, wait till we find a living representative of Galerites to have the question fully decided. I am inclined, in the mean while, to associate the Galeritidae having teeth with the true Echinoids, and consider them as forming among Echinoids a prophetic type of the Clypeastroids, with which they have many points of resemblance.

This subfamily contains elliptical subovoid Echini, with simple ambulacra and remarkably uniform sunken tubercles; no jaws.

ECHINONËUS.

Echinonëus VAN PHEL. 1774. Brief.

This genus has been very generally placed as a subfamily among the Galeritidae. The embryology of Echinolampas shows conclusively that this association is not natural, and that the view first maintained by Lütken of its Cassiduloid affinity is the correct one. Thus far, Echinonëus is the only

genus of this subfamily, though probably other genera will eventually be associated with it. The Echini forming this genus are not large; the test is thin, ovoid; there are no teeth. The actinostome is central and oblique to the longitudinal axis, has no phyllodes nor bourrelets; the anal system is extremely large, more or less pyriform, situated between the mouth and the posterior extremity. The tubercles are large, numerous, arranged in more or less regular rows, no mammary boss, neither crenulated nor perforate. The ambulacra are simple, extremely narrow, extending unbroken from apex to mouth, the poriferous zone forming a narrow vertical band of simple pairs of pores. The presence of so-called glassy tubercles, not carrying spines, irregularly scattered over the test, is a striking feature of this genus. Abactinal system ill defined, four genital pores, spines short, ambulacral suckers provided with disks as in the regular Echini.

Echinonëus semilunaris

Echinus **semilunaris** GMEL. 1788. LINN., Syst. Nat.
! *Echinonëus semilunaris* LAM. 1816. A. s. V.

Pl. XIV. f. 1–5.

Lütken, like myself, has only been able to recognize one species in the West India Islands. As is well known, the difficulty of distinguishing the species in this genus is very great; the more so, as thus far only tests without spines, and without buccal or anal membranes, from uncertain localities, have been used in the determination of species. The Museum has specimens from Cuba, Hayti, and the West Indies, which I have been unable to distinguish by any characters given as specific by Desor in his Monog. des Galérites. The arrangement of the tubercles and of the glassy tubercles is so different in various parts of the test, and in specimens of different sizes, that it is impossible to separate, with any degree of accuracy, the species recognized by Desor, and which had already, in the Catalogue Raisonné, been considerably reduced in number. Having, fortunately, in the Museum Collection, specimens which, without any doubt, were collected at the Sandwich Islands and the Kingsmills Islands, I am able to give a comparative description of the two species I have been able to identify. This will be the more complete, as in some of the Sandwich Island specimens the anal and buccal membranes are still retained, while M. Pourtalès has collected a living specimen with all its spines at Carysfort Reef. I had, in the Bulletin of the Museum of Comparative Zoölogy, adopted the name of *E.* **elegans** DES. as the only name given to specimens which undoubtedly came from the West Indies. Lütken

has perhaps more properly retained the name *E. semilunaris* LAM., which was adopted by Duchassaing, and which has been given by Desor, with some doubt, to a species collected at Trinidad. I would retain for the species from the Sandwich and Kingsmills Islands the name cyclostomus; to judge from the description of the color given by Desor to his E. serialis, the Sandwich Island species may prove identical with it; this name is scarcely applicable, being based upon an arrangement of the ambulacral tubercles, which is frequently met with in specimens of the two species. As far as I am able to discriminate between the tests of these two species, the Pacific species is remarkable for the narrowness of its poriferous zone (*Pl. XIV. f. 7*), the pores being placed in close contact, separated by a ridge carrying small tubercles, while in the specimens of E. semilunaris the poriferous zone is much broader (*Pl. XIV. f. 3*). It has also (taking the same point of the test in specimens of the same size) larger tubercles, and a greater number of large glassy tubercles (*Pl. XIV. f. 7*), while the miliaries are closely crowded together. In E. semilunaris, on the contrary (*Pl. XIV. f. 3*), the primary tubercles, as well as the glassy tubercles, are proportionally much smaller and farther apart, the miliaries being more numerous. From an examination of the alcoholic specimen from Florida, I could not come to any satisfactory conclusion concerning the function of the glassy tubercles; they are not primary tubercles in the course of growth, as they are fully as large, and the primary tubercles, when young, always appear at first as opaque tubercles. They carry no special spines. On living specimens their function will probably be ascertained. Similar glassy tubercles often appear on the edge of very young Clypeastroids (Clypeaster subdepressus), which disappear in older stages. Desor has given figures of the spines; but, in addition to these, the test is thickly covered with stout pedicellariæ carried upon moderately long peduncles. The tentacles do not differ (*Pl. XIV. f. 2*) (as far as could be judged from this alcoholic specimen, where they were still tolerably expanded) from the tentacles of ordinary regular Echini, having prominent sucking disks. The tentacles retain the same structure from the mouth to the apical system. On the lower surface, especially round the mouth and anal system, the spines are longer and more slender (*Pl. XIV. f. 4*) than on the remaining portions of the test. The anal system will, I think, furnish good characters for the determination of species, if we can judge from the striking differences the arrangement of the plates of the anal system presents in the two thus far examined. In the Pacific species (*Pl. XIV. f. 6*) the anal opening is more

pear-shaped; the anus is placed near the blunt end, surrounded by a number of small plates arranged concentrically round it, and extending as a narrow band of small, slender, elongated plates between the single rows of large plates, extending on each side along the other extremity of the anal system. This row of plates consists of five large plates, diminishing in size from the centre of the row towards either extremity; they carry a few large tubercles bearing spines. In the West India species, on the contrary, the anal system is more pointedly elliptical (*Pl. XIV. f. 5*), the anus being placed almost in the centre, surrounded by a smaller number of small plates radiating from it irregularly. The single outer rows are made up of four plates, leaving a triangular space covered by small plates between them and the anus. The rest of the anal system is covered by much larger polygonal plates than in the Pacific species. The buccal membrane is covered by small quadrangular plates, entirely free from spines, arranged in rows radiating from the mouth, diminishing in size towards the opening of the mouth placed in the centre of the membrane. The absence of teeth is fully confirmed by an examination of this specimen.

Littoral.

NUCLEOLIDAE.

Subfamily **Nucleolidae** AGASS., 1847. C. R. Ann. Sc. Nat., VII. p. 147.

ECHINOLAMPAS.

Echinolampas GRAY, 1825. Ann. Phil.

Echini more or less ovoid, apical system eccentric. Ambulacral petals elongate, unequal, the pores of the same petals frequently differently developed. Actinal surface slightly concave. Actinostome transverse, elliptical or pentagonal, more or less eccentric. Floscelle tolerably well marked. Bourrelets moderately prominent. Anal system infra-marginal, transverse. Tubercles of very uniform size; difference in size scarcely perceptible between the actinal surface and the rest of the test.

Echinolampas depressa

! *Echinolampas* **depressus** GRAY, 1851. Ann. Mag. N. H.

Pl. XVI.

In the first dredging expedition of M. Pourtalès, he brought home fragments of the ambulacral rosette of an Echinolampas, which must, to judge from the size of the fragments, have attained a length of about two inches.

What was striking in these fragments was the distinct continuation of the poriferous zone beyond the ambulacral rosette and beyond the ambitus, a feature which would at once distinguish it from either Echinolampas Hellei or E. oviformis. In the second expedition he dredged from a depth of thirty-five fathoms off the Tortugas a small specimen measuring over an inch in length (*Pl. XVI. f. 17–19*). The general outline resembles strikingly that of E. Hellei; it is, however, much more depressed, and differs by the peculiar structure of the ambulacral rosette (*Pl. XVI. f. 21*). Both in the posterior and anterior pairs of ambulacra the rosette is not strictly petaloid; the outer poriferous zones of each of the lateral ambulacra are very irregularly developed. In the posterior pair the anterior poriferous zone (the part forming the rosette) is fully developed to about the point where the rosette usually terminates in the other species of Echinolampadae, while in the inner or posterior poriferous zone the portion where the pores are joined by a groove is not quite half as long as the adjoining poriferous zone. In the anterior lateral pair, the posterior poriferous zone is the short one, and in the odd anterior ambulacrum it is either the left or the right poriferous zone which is the shortest. This same structure also occurs in several fossil species. Unlike the other species of Echinolampas, the outer poriferous zone extends unbroken to the mouth; the two rows of pores are not placed close together; it is always the exterior row of pores which is continued from each zone, and not pairs of pores, as is uniformly represented in all drawings of fossil Echinolampadae. The ambulacral zone also widens between the poriferous zone, as it approaches the ambitus, and as the poriferous zone is sunken and the ambulacral slightly raised, the ambulacra have very much the appearance of the ambulacral zones of Echinonëus. Round the mouth the pores form a very distinct floscelle. What is remarkable in this young Echinolampas is the absence of the peculiar bourrelet (*Pl. XVI. f. 20*) so characteristic of the other genera of Echinolampadae, the only sign we have at present of them being an accumulation of small tubercles closely crowded together, which occupy the interambulacral spaces, and are identical in arrangement with those found on the bourrelet of older Echinolampadae. The peculiar bare space of the actinal interambulacral space so characteristic of some fossil species of Pygorhynchus, is well marked, though in older specimens of Echinolampadae this band nearly disappears, there being but very faint traces of it left. The primary tubercles are by far less numerous in this species than in either the E. Hellei or E. oviformis;

they are not closely crowded, but the secondary tubercles occupy a considerable space round each primary tubercle; this may, however, only be characteristic of the young, as in the fragments of older specimens they are found somewhat more crowded; no spines are found with any of these shells and fragments, and the single whole large specimen had lost its buccal and anal membranes.

The development of Echinolampas depressa has thrown unexpected light upon the affinities of the toothless Galerites and of the Cassidulidae. It shows conclusively that Echinonëus is only a permanent embryonic stage of Echinolampas, thus becoming allied to the Cassidulidae, and that it has nothing in common with the Galerites, as I would limit them, confining them entirely to the group provided with teeth. This reduces the type to a most natural division, and from what we now know of the simple nature of the ambulacra of all Echini in their early stages, I would not give to this feature the significance which it has received, but would be inclined to unite the toothed Galerites with Echinidae proper in the same sub-order, approaching the Clypeastroids by the separation of the anus from the apical system, and retaining the teeth and general symmetrical structure of the regular Echini. I am aware that the great development of Galerites in former geological periods, and the relation of the anus and test, may, on further acquaintance with living representatives, entitle them to rank as a suborder intermediate between the Echini proper and Clypeastroids. Young Echinolampas depressa, measuring a trifle over 4.0$^{mm.}$, are elliptical, resembling Echinonëus, with a large transverse elliptical lobed mouth (*Pl. XVI. f. 2*), the anus placed in the truncated posterior extremity above the ambitus. The outline in profile is almost globular (*Pl. XVI. f. 3*), truncated at the posterior extremity, where the anus is placed. Each plate of the narrow ambulacral zone carries a single principal tubercle (*Pl. XVI. f. 4*), surrounded by a circle of miliaries. The pores are arranged in a vertical row of a single line of pores, three or four for each ambulacral plate, extending from the mouth to the apex. The interambulacral plates are elongated horizontally, and carry from one to three principal tubercles, with numerous small miliaries arranged in circles round the primaries, or irregularly scattered (*Pl. XVI. f. 4*). Seen from above, the outline is elliptical (*Pl. XVI. f. 1*), the madreporic body is quite prominent, the large primary perforated tubercles of the interambulacral area increase in size towards the actinostome, where the miliaries are also less numerous. The spines are comparatively long, resembling those of some of the Clypeastroids.

In specimens twice the size of the above the test is less elliptical, more flattened, and the first trace of a rudimentary rosette appears as a short row of double pores extending from the apex (*Pl. XVI. f. 6*), consisting of from eight to nine pairs, only in one of the poriferous zones of each of the lateral pairs of ambulacra — in the anterior zone of the posterior pair and the posterior zone of the anterior pair of ambulacra — the old ambulacrum remains simple. In specimens measuring about 13$^{mm.}$ this rudimentary one-sided rosette has increased in length (*Pl. XVI. f. 7*), and traces of the second row of double pores are seen in the simple zones near the apex. In specimens measuring an inch (*Pl. XVI. f. 21*), these rows have grown to be half as long as the arc of the rosette first formed; the same structure has also extended to the abactinal part of the odd ambulacrum, and the furrow connecting the pores of the petaloid part of the ambulacra (*Pl. XVI. f. 22*) is as well defined as in any old specimen of Echinolampas. The regular elliptical outline so characteristic of the young specimens when seen from above (*Pl. XVI. f. 1*), and the high globular profile, are gradually changed to a more circular and flattened test, passing through a more or less pentagonal outline (*Pl. XVI. f. 8–10*), and at last with the gradually increasing projection of the posterior extremity the test assumes an ovoid outline (*Pl. XVI. f. 17–19*). While these changes are going on, the miliary tubercles increase rapidly in number, forming clusters of small tubercles, embossing the plates of both areas. This is quite a prominent feature in one of the stages (*Pl. XVI. f. 8–10*). With increasing age the primary tubercles become more numerous, and finally appear as a nearly homogeneous granulation, with closely packed miliaries between, in specimens of about an inch (*Pl. XVI. f. 17–19*). The anal system is covered by three large triangular plates, carrying a few tubercles (*Pl. XVI. f. 5, 14*), the anus opening near the edge of the system, in a narrow slit covered by very minute plates. The mouth, as the young increase in size, becomes more and more sunken, losing little by little its prominently lobed outline (*Pl. XVI. f. 2*), and passing from this stage through that of a slightly sunken actinostome, showing no trace whatever of the bourrelets or phyllodes (*Pl. XVI. f. 9*), to the stage represented in *Pl. XVI. f. 18, 20*, when the phyllodes are plainly laid out, and the first trace of the bourrelet appears as accumulations of minute tubercles closely packed together (*Pl. XVI. f. 20*) between the phyllodes. The buccal membrane is covered with minute plates, the mouth opening in the centre of the membrane (*Pl. XVI. f. 2, 9*), as a diminutive slit. When measuring about

half an inch in length (*Pl. XVI. f. 8–10*), the young Echinolampas resembles Caratomus to such an extent that this stage was considered for a time a living representative of Caratomus. The larger series collected by Mr. Pourtalès, in his second expedition, showed conclusively the relationship to Echinolampas, and proves the correctness of the step taken by Desor in removing Caratomus and allied genera from the Galeritidae, and placing them among the Cassidulidae, on account of the semipetaloid nature of the apical portion of the ambulacra. Bifurcate pedicellariae with a short stem (*Pl. XVI. f. 15*) and a large transparent head are irregularly scattered over the test; the spines resemble those of Clypeastroids (*Pl. XVI. f. 16*), being short, slender, straight, the secondary spines silk-like. The tentacles, as far as could be ascertained from alcoholic specimens, are provided with a powerful sucking disk; they are covered by dark pigment cells (*Pl. XVI. f. 13*) as long as the specimens retain the aspect of Caratomus. The character of the tentacles does not change in any part of the poriferous zone. They retain their disk even after the petaloid nature of the abactinal part of the ambulacra is fully developed and the pores are joined by a well-defined furrow; so that we have the apparent anomaly of sea-urchins with petaloid ambulacra, yet possessing only tentacles differing in no way from those of the regular Echini. A similar state of things has been shown to exist in the young of Echinanthus rosaceus at an age when the denuded petaloid ambulacra appeared to differ in no wise from those of the adult, carrying well-developed lobed tentacles in the petaloid portion of the ambulacra; yet a young specimen, measuring over an inch, was only provided with tentacles terminating in a powerful sucking disk.

The bare part of the posterior interambulacral area between the anus and the actinostome, often so prominent in the adult, is not apparent in the young, and is formed by minute miliary granulation, encroaching more and more with increasing size upon the larger primary tubercles of the actinal surface. There are no teeth nor signs of auricles in these young, so that we can assume that the genera now associated with Cassidulidae, allied to the Caratomus and the like, were, as well as Echinonëus, edente.

From 35 – 160 fathoms.

NEOLAMPAS.

Neolampas A. AGASS. 1869. Bull. M. C. Z., I., No. 9, p. 271.

Test thin; outline pyriform from above, profile regularly arched, posterior extremity truncated, anal opening projecting as a tube; tubercles of uniform size over the whole test, raised above the surface of the test; no ambulacral petals; ambulacral system simple, reduced to single pores between the ambulacral plates, extending from the apex to the actinostome. Floscelle and bourrelets well developed.

Neolampas rostellata

! **Neolampas rostellatus** A. AGASS. 1869. Bull. M. C. Z., I., No. 9, p. 271.

Pl. XVII. f. 1–12.

Outline from above resembling Echinolampas (*Pl. XVII. f. 1*), more elongated, three large genital openings, placed closely together, the right or left anterior one atrophied, madreporic body restricted to a narrow ridge separating them. Seen in profile (*Pl. XVII. f. 3*), the test rises gradually from the anterior extremity towards the apical system, attaining its greatest height between it and the posterior extremity; this is sharply truncated anteriorly, as in some species of Catopygus. The lower surface (*Pl. XVII. f. 2*) is concave, undulating; the anal system (*Pl. XVII. f. 4, 5*) is large, elliptical, occupying the whole of the posterior truncated end, somewhat as in Botriopygus, the test being turned in like the finger of a glove, while the anus opens at the end of a long slender tube, projecting well beyond the outline of the test (*Pl. XVII. f. 6*), the anal tube starts from the upper part of the anal membrane, this is covered by small plates (*Pl. XVII. f. 5*), gradually diminishing in size, and eventually firmly soldered together to form the base of the anal tube. Test thin, mouth placed near the anterior extremity, having a well-developed floscelle and prominent bourrelets (*Pl. XVII. f. 9*). The test is covered by minute tubercles of different sizes (*Pl. XVII. f. 8*), not separated into primaries and miliaries, as in Echinolampas. The tubercles are not sunk, but stand out prominently from the test, having a smooth mammillary boss and a rough scrobicular area. The spines are straight, very fine, slightly club-shaped, resembling those of the Scutellidae (*Pl. XVII. f. 10*). There is no ambulacral rosette, so prominent in all the Echinolampadae. From an

external examination alone it would be difficult to trace the course of the ambulacra, but from the interior (*Pl. XVII. f. 11*) we easily see one pore for each ambulacral plate, extending from the floscelle to the apical system, and appearing as minute pores when seen from the outside; through them protrude very slender tentacles showing no trace of disk. In fact, the structure of the whole of the ambulacra is identical with the structure of the part of the ambulacra between the rosette and the mouth in other Echinolampadae. The color of this Sea-urchin is yellowish-green, and I am convinced it is not the young of any other Echinolamp, in spite of its size (14.7$^{mm.}$), owing to the great development of the bourrelets, which in other Echinolampadae appear only after the specific characters are fully formed and the main features of the adult are attained.

There is a peculiar structure of the ambulacra of Cassidulidae which seems to have escaped notice thus far. The rosette is formed by two poriferous zones, each containing two pores joined by a furrow. The poriferous zone, which extends from the petals to the floscelle (mouth), is reduced to its simplest expression, a single pore between two adjoining ambulacral plates; it is only the inner set of pores of the poriferous zone which extends to the mouth in all the ambulacra; the exterior pair does not go beyond the rosette. The buccal membrane is bare, the mouth itself exceedingly minute. The bourrelet between the floscelle is well marked by the crowded tubercles packed as closely as they can be placed. The floscelle is well defined, consisting of large elliptical pores; there are only three of the inner set of pores. I was at first tempted to regard this genus as the young of a new Echinolamp, on account of the absence of the ambulacral rosette. But having found in a young Echinolampas the ambulacral rosette developed before the bourrelets, I take it for granted that this species has the principal specific characters of the adult, unless this genus forms an exception to all other Echini allied to it, as in all young Clypeastroids, Spatangoids, and Echinolamps which I have examined, long before we can tell with certainty to which genus the young Echinoderm is to be referred, such an important character as the ambulacral rosette is already well developed (Encope, Mellita, Echinarachnius), or at any rate more prominent than the remaining portion of the ambulacral system.

From 100–125 fathoms.

(CASSIDULUS.) RHYNCHOPYGUS.

Rhynchopygus D'ORBIG. 1855. Pal. Franç.

Lamarck's genus Cassidulus, as established in 1801, contains in it two distinct types: Cassidulus lapis caneri; the species from the West Indies and Cassidulus Marmimi. This has been separated as a distinct genus, Rhynchopygus, by Desor, with which the recent species of the genus must also be associated, as has been proposed by Lütken. After an examination of a fine series of fossil species of the genus Cassidulus, I have been led to modify the opinion I had expressed of the affinities of our recent species, and to return to the view originally proposed by Desor and Lütken of uniting the recent West Indian species to the genus Rhynchopygus, regarding this, however, only as a subdivision of Cassidulus; for, notwithstanding the transverse position of the anus, covered in part by a projection of the test, and the absence of a prominent anal furrow, we find in the species of the genus Cassidulus indications that these characters are not of primary importance, though in the present state of our knowledge they may serve to subdivide the genus conveniently. The separation I had made in the Preliminary Report as Rhyncholampas of our recent Atlantic and Pacific species is not warranted; a series of C. Marmimi shows that the smooth band of the actinal surface and the position of the large tubercles are subject to great variation, reducing the distinctions to merely specific characters. The genus Rhynchopygus includes, as here limited, species with a thin test, well developed petaloid ambulacra; four genital openings; a transverse anal system placed above the edge of the test, covered by a projection of the overhanging interambulacral part of the test; a slightly marked anal furrow. The lower surface is slightly concave, sloping towards the outer edge; mouth eccentric anteriorly, bourrelets and phyllodes highly developed; a broad bare band extending from one extremity of the test to the other. Tubercles of the upper part of the test uniform, small, resembling Clypeastroid tubercles; tubercles of the lower part large, deeply sunken as in Spatangoids; adjoining bare band, they gradually diminish in size towards the edge of the test. Apical system more central than mouth, eccentric anteriorly.

Rhynchopygus caribaearum

! **Cassidulus caribaearum** LAMK. 1801. An. s. Vert.
! *Rhynchopygus caribaearum* LÜTK. 1864. Bid. til Kunds.

Pl. XV. f. 1–4.

Mr. Pourtalès brought home fragments of this species showing that it must equal in size its Pacific representative. As it has been figured frequently, and described so well by Lütken, I will only call attention to a few points of difference between the East and West Coast species. The bare actinal band of the West India species is deeply pitted with longitudinal, round and elliptical pits and furrows (*Pl. XV. f. 3*), the edges surmounted by minute tubercles, carrying extremely delicate spines, resembling in every respect the structure of the microscopic spines of the fascioles of the true Spatangoids. This band is broad and elliptical, in the West India species, in the posterior actinal part of the test, while in the Pacific species it is narrow even near the actinostome, tapering very rapidly to a point near the anal extremity. The plates of the anal system, arranged in three rows, are broader and longer than in the Pacific species, where they are arranged in two rows only, the outer row being the largest. In the Pacific species the pits of the smooth band are reduced to a few indistinct impressions, the whole band being thickly covered by minute silk-like spines. The floscelle is most distinct also, while, owing to the sculpture of the bare band round the mouth in the West India species, its outline cannot always be distinctly traced.

There are unfortunately no specimens of these two species of the same size in any of the collections I have examined, making a more accurate comparison impossible; the Pacific species, being evidently full grown, will be described at greater length. The difference in the length of the poriferous zones both of the anterior and the posterior lateral ambulacra, so marked in the Pacific species, exist already in the smallest specimen, about three quarters of an inch in length, which I have examined. No pedicellariæ have been detected in this species.

Fragments in 106 fathoms.

SPATANGIDAE.

Family **Spatangidae** AGASS. 1841. Prod. Mon. Rad. (emend.)

ANANCHYTIDAE.

Subfamily **Ananchytidae** ALB. GRAS, 1848. Ech. foss. Isèr.

This subfamily includes Spatangoids having ambulacra flush with the surface of the test, the apical system more or less elongate, but not disconnected. The anterior groove disappears in some genera, as in Cassiduloids. The discovery of the genera Neolampas and Homolampas, where we find the spatangoid structure of the actinostome, as well as that of the form without bourrelets but with phyllodes, shows that the Ananchytidae are not as disconnected a group among Spatangoids as we have been led to suppose thus far, the genus Neolampas showing the possibility of finding Cassiduloids without the bare bands of the actinal surface, yet having the simple pores of the Ananchytidae and the peculiar structure of the mouth of the Cassidulidae, though not showing the faintest tendency to the development of plastrons so characteristic of the other Spatangoids.

POURTALESIA.

Pourtalesia A. AGASS. 1869. Bull. M. C. Z., I. p. 272.

This genus is the living representative of Infulaster of the cretaceous period, holding the same relation to it which Rhynchopygus, with its projection covering the anus, holds to Echinolampas, if the posterior part of the test of the former were drawn out into a long spout. The outline of this genus, as well as of Infulaster, is very peculiar, and at first sight no one would take for a Sea-urchin the elongate, bottle-shaped body with its thin and transparent test. It is more like a Holothurian; the anus is at one extremity supramarginal, while the mouth is placed at the other. The short, vertical diameter, as compared to its length; the absence of any feature which would indicate the presence of a petaloid ambulacral rosette; the long, slender, curved spines, far apart, supported upon peculiar tubercles, mark this genus as one of the most interesting brought to light by

Mr. Pourtalès. It forms a valuable link in our appreciation of the affinities of Spatangoids proper with Spatangoids in which the mouth is not labiate.

Test thin, bottle-shaped, when seen from above; vertically truncated anteriorly, the anterior apex corresponding to the abactinal pole, in profile the outline is rectangular, convex below; the posterior actinal part of the test projecting far beyond the anus like a proboscis; the posterior extremity cut out to receive the pit occupied by the anal system. Seen endways, the test is heart-shaped; mouth elliptical, not labiate, sunken in a deep actinal groove; abactinal and actinal plastrons narrow, elongated, formed of closely packed tubercles. Tubercles few in number, with large scrobicular circle carrying long curved spines slightly fan-shaped at the extremity. Smaller spines spatulate; four genital openings. Ambulacral pores extending as simple rows from the apex to the actinostome. Ambulacral suckers pointed.

Pourtalesia miranda

1 **Pourtalesia miranda** A. AGASS. 1869. Bull. M. C. Z., I. p. 272.

Pl. XVIII.

Seen from above (*Pl. XVIII. f. 3*), the outline is bottle-shaped, the neck being the posterior extremity. At the base of the neck the test carries a deep pit, surmounted at its exterior extremity by a rostrum projecting from the test, and under this, at the bottom of the pit, is placed the anus (*Pl. XVIII. f. 6, 7*). Seen in profile, the anterior extremity is almost vertically cut off (*Pl. XVIII. f. 1*), the test arching regularly from the apical system to the rostrum, where it is abruptly cut off, forming a regular curve to the posterior extremity, this extends beyond the anal system like a snout thickened at the end (*Pl. XVIII. f. 5*), surmounted at its extremity by an accumulation of minute tubercles, colored dark violet, which carry no spines. The lower surface is convex, regularly arched from the posterior to the anterior extremity (*Pl. XVIII. f. 1*). The posterior pair of ambulacra extend on both sides of an elongated plastron to the base of the snout-like prolongation, where they curve sharply upwards, and run close to the abactinal part of the test (*Pl. XVIII. f. 1*), to the abactinal system situated almost at the summit of the nearly vertical anterior extremity, along a marked wedge-shaped ridge, extending from the apical system into the rostrum protecting the anus. The anterior pair of ambulacra take a similar course in the opposite direction, but curve more regularly (*Pl. XVIII. f. 4*),

following very nearly the edge of the deep anterior groove in which the odd anterior ambulacrum (*Pl. XVIII. f. 4*) is placed.

The odd ambulacrum is made up of two lines of pores far apart (*Pl. XVIII. f. 8*). The abactinal system, consisting of four large genital openings (*Pl. XVIII. f. 9*) placed close together, with the madreporic body tolerably well defined in the centre, is situated at the origin of the anterior groove; this is flanked by prominent ridges extending from the apical system, gradually disappearing towards the mouth, placed at the outer extremity of the anterior groove (*Pl. XVIII. f. 4*); this increases in depth on the lower surface (*Pl. XVIII. f. 2*), resembling in fact the anal groove of Echinobrissus, and allied genera, in an inverted position. The actinal system is elliptical, the long axis in the trend of the groove very large, with sharply defined edges covered by very minute plates (*Pl. XVIII. f. 8*). There are no indications of a floscelle. The odd ambulacrum carries large, thick tentacles, with rounded extremity, moderately close together (*Pl. XVIII. f. 19*); while the tentacles of the other ambulacra are placed, one for each plate, far apart, so as to readily escape notice, isolated as they are in the midst of the prominent and peculiar pedicellariæ which are so abundant, especially along the line of the posterior ambulacra. These pedicellariæ consist of a stem upon which articulate three slender, contractile arms (*Pl. XVIII. f. 16, 17, 18*), each terminating in a disk, with milled edges.* There is no petaloid portion in the ambulacra; they are all composed of simple pores from the mouth to the apical system. The spines are long, curved at the base, as in Spatangoids (*Pl. XVIII. f. 10*); the tubercles to which they are attached have a smooth scrobicular area. The mammary boss is small, crenulated, perforate in old, imperforate in younger tubercles, surrounded by a large granulated scrobicular area (*Pl. XVIII. f. 11*), and raised above the surface of the test, to which the milled ring is attached by a very flexible muscular membrane (*Pl. XVIII. f. 12, 13*). There are smaller spines of a similar structure, somewhat more fan-shaped (*Pl. XVIII. f. 14*); scattered irregularly over the test, but quite distant. The whole appearance of the test is bare, the primary tubercles carrying long spines being placed far apart in the lateral posterior interambulacral areas (*Pl. XVIII. f. 1*); and it is only on the ridges along the anterior groove, round the mouth and anus, that the small spatulate spines (*Pl. XVIII. f. 14*) are closely packed together.

* By an oversight, the description of these pedicellariæ, in the Preliminary Report, became connected with that of the tentacles.

Radiating from the apex towards the mouth, and extending along the abactinal plastron (*Pl. XVIII. f. 3*), there are masses of pigment cells forming lines of dark violet spots, also a similar series of spots round the extremity of the anal prolongation of the test, particularly marked on the edge of the pit leading to the anal opening. The test is extremely thin, transparent, of a bluish-gray color in alcohol, in this specimen, as well as in a still younger specimen collected by the Porcupine Expedition. In an older specimen, also dredged by the Porcupine Expedition, the test was much stouter. From the above description it is evident that Infulaster and the Ananchytidae must have had a structure allied to that of Pourtalesia, and are embryonic Spatangoids, still retaining some features of Clypeastroids, while the features characteristic of young Spatangoids are prominently developed.

A single specimen of this interesting genus was dredged at a depth of 349 fathoms.

HOMOLAMPAS.

Homolampas A. Agass. 1872. Rev. Echin. Pt. I.

This genus is intermediate between Cardiaster and Holaster. It has, like those genera, ambulacra flush with the test, but, unlike Holaster, has a well-developed anal and subanal fasciole, while it wants the lateral fasciole of Cardiaster. The ambulacral pores form no petals; they extend as simple pores between the ambulacral plates from the phyllodes to the apex. The actinal surface is flat; the actinostome is pentagonal, not bilabial, with well-developed phyllodes, but without trace of bourrelets, — a strong connecting link between the Cassidulidae and Spatangoids proper. The compactness of the apical system of this genus is in marked contrast with its structure in allied genera, such as Cardiaster and Holaster.

The general outline of the test resembles Maretia, but is somewhat more elongate. It is closely allied to Platybrissus, but the presence of a subanal fasciole, as well as a slight anterior groove, readily distinguish the two genera, in addition to the presence of a rudimentary rosette in Platybrissus, wanting in this genus.

Homolampas fragilis

! *Lissonotus* **fragilis** A. AGASS. 1869. Bull. M. C. Z., No. 9, I. p. 273.
! **Homolampas** *fragilis* A. AGASS., 1872. Rev. Ech. Pt. I.

Pl. XVII. f. 13–21.

Test thin; from above heart-shaped, elongate (*Pl. XVII. f. 15*). Seen in profile (*Pl. XVII. f. 14*), it is regularly arched anteriorly from the lower side to the apex, running then almost horizontally, and abruptly bevelled at the posterior extremity. The ventral plastron is small (*Pl. XVII. f. 13*), triangular, surmounted by an elliptical subanal fasciole (*Pl. XVII. f. 19*), surrounding the anal plastron, which projects like a rounded keel below the anal system. The spines of the lower surface are large and few in number, confined entirely to the edge of the test, leaving broad, bare bands in the ambulacral areas and adjoining parts, while on the rest of the test the tubercles are minute, carrying small, fine spines, with the exception of three large, crenulate tubercles (*Pl. XVI. f. 21*), surmounted by curved spines (Lovenia-like) placed near the edge, in the anterior extremity of the test (*Pl. XVII. f. 17*). The tubercles are also somewhat larger on the sides of the anterior groove, and more closely packed in the posterior interambulacral space, from the apex to the anal system, than in remaining parts of the test. The plates of the two posterior ambulacra are comparatively broad, while all the other ambulacra are made up of smaller plates. The actinal system is pentagonal, the mouth is placed near the posterior edge (*Pl. XVII. f. 16*). The tentacles of the phyllodes are represented in different stages of development in *Pl. XVII. f. 20*. The portion of the poriferous zone extending from the phyllodes to the apical system is made up of simple pores, one for each ambulacral plate, so that the ambulacral areas, seen from above, are scarcely perceptible, marked only by the somewhat more closely packed minute tubercles (*Pl. XVII. f. 18*) covering the ambulacral plates. There are three large genital openings; the right anterior one is obliterated. The anal system is transversely elliptical (*Pl. XVII. f. 19*), its membrane is covered by minute granulation; an indistinct branch of the subanal fasciole extends along the lower side of the opening; the anus itself opens in a delicate tube, similar to that of Neolampas, but shorter, frequently forming a mere lip. The whole test is mottled with dark spots; the ground-color is grayish, with a purplish tinge.

From 320 to 368 fathoms.

SPATANGINA.

Subfamily **Spatangina** GRAY, 1855. Cat. Rec. Ech.

ECHINOCARDIUM.

Echinocardium GRAY, 1825. Ann. Phil.

Test thin, heart-shaped. Ambulacral petals more or less triangular, interrupted at apex by an internal fasciole; pores of lateral pairs of ambulacra distant, broad anterior ambulacrum formed of small pores situated in a more or less distinct groove. Anal system placed in the vertically truncated posterior extremity. Subanal fasciole with ascending branches around anal system. Spines of lower surface long, spatuliform, while those of the rest of the test are thin and silk-like. I attempted formerly to distinguish Amphidetus and Echinocardium on account of the more ovoid shape of the test and the disconnected posterior fascioles of (Amphidetus) Echinocardium flavescens; the little thus far known of the development of Echinocardium cordatum shows satisfactorily that such characters are not generic.

Echinocardium cordatum

Echinus **cordatus** PENN. 1777. Brit. Zoöl.

! *Echinocardium cordatum* GRAY, 1848. Brit. Rad.

Pl. XIX. f. 10–17; Pl. XX. f. 5–7.

Test thin, heart-shaped from above, vertex posterior, test rising gradually as a rounded keel beyond the internal fasciole, truncated at both extremities, odd ambulacrum sunken more than the lateral ones, the test forming a ridge on both sides of the anterior depression. The abactinal portion of the odd sunken ambulacrum is bounded by the broad internal fasciole, this gradually becomes narrower towards the anterior extremity. The pores of the odd ambulacrum are small, comma-shaped, so closely packed together on the flat portion of the groove as to alternate, though arranged singly towards the abactinal pole and towards the actinostome. Four ovarian openings diverging posteriorly. The anterior rows of pores of the lateral ambulacra are obliterated by the internal fasciole. The lateral ambulacral petals are triangular; adjoining rows of pores of the lateral ambulacra form crescents in the lateral and posterior ambulacral spaces. The anal system is vertically elliptical. The

subanal fasciole is lanceolate, extending to a beak, bounded by a broad fasciole, narrowing rapidly towards the actinal surface. The bare ambulacral spaces round the mouth taper rapidly towards the edge of the test. The spines are short, hair-like, except on the oval plastron and the edge of the test, where they are large and spatulate. Color, when alive, yellowish-white. Alcoholic specimens often of a gray color, with pinkish tinge or darker yellowish.

The specimens of this species collected upon our shores had in the Preliminary Report been referred to *Echinocardium* **Kurtzii** of Girard, for want of sufficient European material to make a satisfactory comparison of the specimens occurring on both sides of the Atlantic. This comparison has now been made, and shows the identity of the specimens from both sides of the Atlantic. Fragments of this species were collected by Mr. Pourtalès. Our American specimens, of which the Museum possesses excellent series, show differences confined almost entirely to a portion of the test, subject to the greatest variation in Spatangoids. These consist in the greater prominence of the posterior abactinal interambulacral ridge, the more circular anal opening covered by a slightly larger number of plates than in the European specimens, where they are often larger and fewer in number; the extremity of the subanal plastron also projects, and is more prominent; — differences which can be found in a large series from any one locality in different individuals.

Littoral to 85 fathoms.

Young specimens measuring only 6.3$^{mm.}$ in longitudinal diameter have already a labiate mouth, and, as in young Brissopsis, we find very early all the generic features of Echinocardium fully developed, and no one could fail to recognize even in such small specimens the young of E. cordatum. The anterior ambulacrum is as deeply sunk, in proportion to the size of the specimen (*Pl. XIX. f. 11*), as in the adult specimens; the intrapetalous fasciole is fully laid out (*Pl. XIX. f. 15*), though it has a very different outline, being triangular; the lateral ambulacra are totally disconnected as yet; the petals are still linear (*Pl. XIX. f. 15*), and have not yet assumed the characteristic triangular shape of the adult (*Pl. XIX. f. 16*); the anal membrane protrudes, somewhat trumpet-shaped, from the anal system; the subanal fasciole and anal branch are at first united (*Pl. XIX. f. 14*), but as the specimens increase in size, the anal branch separates from it (*Pl. XIX. f. 17*). The actinal plastron is extremely prominent, and in young specimens the outline of the posterior extremity in profile resembles E. mediterraneum. The

odd ambulacral zones are at first two single rows of pores (*Pl. XIX. f. 15*), which by closer crowding eventually alternate, but are not arranged in pairs (*Pl. XIX. f. 16*).

Echinocardium flavescens

Spatagus flavescens MÜLL. 1776. Prod. Zool. Dan.
! *Echinocardium flavescens* A. AGASS. 1872. Rev. Ech., Pt. I.

Pl. XX. f. 3, 4.

Test oval; stouter than in the other species of the genus; seen in profile quite regularly arched, though truncated at the posterior extremity, the posterior interambulacral ridge extending over the anal system. The ambulacra are very slightly sunken, not as much as in E. cordatum, but more than in E. mediterraneum; the anterior one is frequently nearly flush with the test. The abactinal pole is nearly central. The internal fasciole is elliptical, remarkable for the great breadth of the space it encloses. The actinostome of this species and of E. pennatifidum is not narrow and transverse as in the species mentioned above; it is broader, with a straighter posterior lip. The anal system is large, slightly elliptical, transverse. The color, when alive, is pinkish.

An examination of young specimens of Echinocardium cordatum shows that the generic distinction which I attempted to make between Amphidetus and Echinocardium, based upon the isolation of the anal from the subanal fasciole, and thus separating the group with a deep anterior groove from these with a slight anterior groove, is untenable. The presence of two identical species of Echinocardium on both sides of the Atlantic is certainly remarkable, but I am unable to distinguish the fragments of specimens collected by Mr. Pourtalès and unmistakably identical with a fine specimen of Echinocardium flavescens collected at Charleston, S. C., in the Museum collection, from European specimens of this species.

— to 128 fathoms.

Echinocardium pennatifidum

Amphidotus gibbosus (Barrett), 1857. Ann. Mag. N. H., XIX. p. 32 (non AGASS.).
Echinocardium **pennatifidum** NORM. 1868. 4th Dredg. Rept.

Pl. XX. f. 1, 2.

This species combines the general appearance of Echinocardium mediterraneum with the structure of E. flavescens. Its outline resembles that of E. cordatum, but it has, like E. flavescens, the anterior ambulacrum scarcely sunken.

It has a high test, the ridge between the posterior ambulacra being quite prominent, regularly arched as in E. flavescens, but extending as a well-marked rostrum over the anal opening; this is somewhat pear-shaped, and comparatively smaller than in the other species of the genus; the arrangement of the anal plates is similar to that of E. flavescens; the apical part of the odd ambulacrum is narrow, the internal fasciole being very elongated, elliptical, including an extremely narrow space, the sides of the test sloping up very gradually like a roof towards the apex, which is anterior, and placed at a distance of about one fourth the longitudinal diameter of the test from the anterior extremity, thus differing strikingly from either E. flavescens or E. cordatum, in which the junction of the ambulacra is either almost central or eccentric posteriorly; the posterior ambulacra are much shorter than in E. flavescens. The whole upper surface of the test is covered with very minute tubercles, as in E. cordatum, with the exception of a few larger ones along the edge of the anterior ambulacral zone. On the lower side they are large, as in E. flavescens, having the same general outline; the bare actinal spaces are far wider, the tubercles not extending so far towards the mouth from the ambitus as in E. flavescens. The posterior extremity is almost vertically truncated, the plastron is much smaller than in E. flavescens; the subanal plastron is less broad, and higher.

Length.	Trans. Diam.	Height.
37.1	31.7	21.

From 79–121 fathoms.

The existence of a species of Echinocardium having the outline of Echinocardium cordatum, but the slight odd ambulacral groove of Echinocardium flavescens, is an additional proof of the identity of Echinocardium and Amphidetus, as they had been limited in the Museum Bulletin, No. 2. The present species, of which but a single specimen was collected, is closely allied to E. mediterraneum; not having in 1869, when the Preliminary Report was written, sufficient material to make a thorough comparison which might prove their identity, I gave the points of difference observed in the specimens compared. A good figure of *E.* **pennatifidum** of Norman having been given by Hodge in the Transactions of the Northumberland and Durham Natural History Society, there seems but little doubt that the species I called **laevigaster** in my Preliminary Report is the same as the E. pennatifidum dredged by him on the west coast of Scotland.

BRISSINA.

Subfamily **Brissina** GRAY, 1855. Cat. Rec. Ech.

AGASSIZIA.

Agassizia VAL. 1846. Voyage Vénus, Atlas.

Test thin, ovoid, differing from all other Spatangoids in having the anterior pair of petals composed of single poriferous zones. Peripetalous fasciole and lateral fasciole connected and passing under anus.

Agassizia excentrica

! *Agassizia* **excentrica** A. AGASS. 1869. Bull. M. C. Z., No. 9, I. p. 276.

Pl. XIV. f. 9–12; Pl. XIV. f. 23, 24.

I am somewhat inclined to consider this species as the Agassizia porifera; but not having any original specimens for comparison, and the drawings of Ravenel and McCrady showing rather striking differences, I will not take their identity for granted, and compare it only with its West Coast representative, from which it can at once be recognized by the position of the apical system, which is much more eccentric posteriorly; on this account the disparity between the odd anterior pair of ambulacra and the posterior pair is greater than in that species. The interambulacral plastron is elliptical, and with this exception the arrangement and proportion of the tubercles is that of **A. scrobiculata** VAL. The peripetalous fasciole does not pass below the ambitus, and the posterior fasciole makes a sharp angle under the anal opening. Only two denuded tests were collected, so that no further details can be given about this species.

From 36 to 115 fathoms.

It is with considerable doubt that I refer to Agassizia small Spatangoids (*Pl. XIV. f. 9–12*) having, like it, a peripetalous and lateral fasciole and the peculiar structure of the ambulacral petals of the genus, not limited, however, to the anterior ambulacra, but extending to all the petals. The flat test (*Pl. XIV. f. 12*) is also unlike what has thus far been found to be the shape of young in other Spatangoids (Moira, Echinocardium, Spatangus), and further material may yet prove this to be the young of an undescribed Spatangoid,

though, judging from the analogy, there is nothing excepting the flatness of the test which would be contrary to its being the young of either Agassizia or Schizaster.

The young Agassizia, 6.2$^{mm.}$ in length, is a flat elliptical Spatangoid (*Pl. XIV. f. 9*) resembling Gualteria. The peripetalous and lateral fascioles have the same general limits as in the adult, but the arrangement of the pores in all the ambulacra is identical (*Pl. XIV. f. 11*); there is but a single pore for each ambulacral plate, as it exists in the anterior pair and odd ambulacra of the adult; the ambulacral grooves are not yet formed, the anterior groove alone being slightly indicated; the mouth is very slightly labiate (*Pl. XIV. f. 10, 12*).

(HEMIASTER.) BRISSOPSIS.

Brissopsis AGASS. 1840. Cat. Syst. Ectyp.

Test thin, more or less ovoid; the apex is nearly central, the odd anterior ambulacrum but little prominent, ambulacral petals unequally developed. Subanal fasciole and peripetalous fasciole entire. This genus does not seem to be entitled to rank as more than a subgenus of Hemiaster, where we have a subanal fasciole; while Toxobrissus, which is said to have no subanal fasciole, cannot, it seems to me, be separated from Hemiaster simply on account of the divergence of the ambulacra as proposed by Desor, a feature which is strictly one of growth, and not one to be taken as a permanent character. Kleinia, as based upon the original specimen (**Kleinia luzonica**) of Gray, certainly is nothing but a Brissopsis, having a most distinct subanal fasciole. If the subanal fasciole is really absent in Toxobrissus, it cannot, as Lütken considers it, be identical with Kleinia. It may be that other characters will yet be traced to separate it from Brissopsis; if not, then Kleinia and Toxobrissus will both become synonymous with Brissopsis.

Brissopsis lyrifera

! *Brissus* **lyrifer** FORBES, 1841. Brit. Starf.
! *Brissopsis lyrifera* AGASS. 1847. C. R. Ann. Sc. Nat.

Pl. XIX. f. 1–9; Pl. XXI. f. 1–2.

Test thin, ovoid, depressed; profile regularly arched, truncated posteriorly; vertex posterior; peripetalous fasciole moderately broad, somewhat flexuous; posterior portion very distinct, less clearly defined towards anterior; all am-

bulacral petals uniformly sunken, posterior ambulacra shortest. Tubercles more closely crowded within the peripetalous fasciole; four ovarian openings close together, nearly central. The pores of the lateral ambulacra are so arranged as to form equally distant longitudinal rows. The anal system is nearly circular, slightly elliptical vertically, distant from the subanal fasciole, with a row of large plates round the exterior edge, the largest plates near the anal fasciole, the remaining part covered by small plates. The subanal fasciole is elliptical, strongly concave towards the anal system, sending off an indistinct branch to the peripetalous fasciole. The tubercles of the subanal plastron are closely packed, the spines usually arranged in two tufts on each side of the median line. There are but few tubercles in the prolongation of the petals; they are also less numerous in the median interambulacral spaces, where the test is frequently quite bare. The actinal plastron is very prominent, and the whole actinal surface is crowded by large tubercles of uniform size, largest near the actinostome. The bare ambulacral spaces are very broad, particularly the posterior ones. Forbes says of its color when alive, "a red body with pale yellowish spines, the dorsal and postanal impressions of a rich brownish-purple."

The only difference to be traced, after a careful comparison, between Florida and European specimens, is the existence of a distinct branch of the subanal fasciole extending round the anal system to the peripetalous fasciole (*Pl. XIX. f. 4*). In European specimens there are traces of this branch, but it is not distinctly and sharply defined as in the Florida specimens. The subanal fasciole seems, from all I can gather after an examination of Spatangoids in various stages of growth, the only one subject to decided changes, and it is not remarkable that we should have in Brissopsis similar variations, in the subanal fasciole, to those upon which Troschel has founded his genera Abatus, Hamaxitus, and Atrapus, — changes which, in Brissopsis at least, are due to different stages of growth. The character of continuity of the adjoining pairs of ambulacra, which Desor assigns to Toxobrissus as a distinguishing feature, becomes more and more apparent according to the size of the specimens; so much so, that we should place Brissopsis lyrifera, when young, in Brissopsis, but when full grown it would most decidedly pass for a Toxobrissus.

Young Brissopsis lyrifera, less than a quarter of an inch in length, are cylindrical (*Pl. XIX. f. 1–3*), the mouth having a flat, crescent-shaped edge (*Pl. XIX. f. 3*), the test truncated vertically at the posterior edge (*Pl. XIX. f. 2*), surrounded by a prominent elliptical subanal fasciole; the peripetalous

fasciole is elliptical, undulating; the anus is placed near the posterior extremity of the peripetalous fasciole. In still younger specimens the peripetalous fasciole is rectangular, with rounded corners and concave sides, extremely broad (*Pl. XIX. f. 7*), while, as it widens with the increased length of the ambulacra, it becomes much narrower.

The odd ambulacrum carries four or five large tentacles with lobed disk (*Pl. XIX. f. 2*); the pores of the odd ambulacrum are single, not in pairs; the other ambulacra are short, straight, well defined, consisting of three and four pairs of pores not yet conjugated (*Pl. XIX. f. 7*). In older specimens the posterior edge of the mouth becomes labiate, the anus approaches the subanal fasciole, which sends out a rudimentary anal branch (*Pl. XIX. f. 4*), eventually uniting with the peripetalous fasciole, the outline of which becomes more pentagonal (*Pl. XIX. f. 8*), undulating, and elongated with the increasing size of the petaloid ambulacra. The posterior edge becomes more bevelled with age (*Pl. XIX. f. 6*), the subanal plastron more prominent, the lateral pairs of ambulacra gradually tend to unite, passing from a strictly Brissopsis outline (*Pl. XIX. f. 8*) to one considered hitherto characteristic of Toxobrissus (*Pl. XIX. f. 9*). The spines in all young Spatangoids are strikingly larger in proportion to their size than in the adult.

From 55 to 156 fathoms.

BRISSUS.

Brissus KLEIN, 1734. Nat. Disp.

Echini with elongate test; apex eccentric anteriorly, often attaining very large size; anterior ambulacrum nearly obliterated, flush with test, or placed in a furrow of little depth. Other petals more sunken; anterior ambulacra more transverse than the posterior. Anal system moderately large; tubercles, except on each side of anterior furrow, and within the peripetalous fasciole, remarkably uniform in size; peripetalous fasciole exceedingly angular, with a very prominent subanal fasciole; four genital pores, anterior small, close together, posterior ones larger and distant; spines very uniform in size, except on the actinal surface and on each side of the bare band, where they are quite long and well developed.

Brissus unicolor

! Brissus unicolor KLEIN, 1734. Nat. Disp. Ech.

Pl. XXII. f. 1, 2.

A large number of species of the genus Brissus have been named, but when we attempt to define their specific differences we have but a small number left which can be distinguished with any degree of certainty. A fine series of specimens from the Mediterranean which the Museum owes to the kindness of Professor Panceri and Mr. Rigacci, specimens from the Cape Verde and Canary Islands, the collections of Paris and of Professor Haeckel, show such an extraordinary variation in all the characters which have been employed to distinguish the species of this genus, that I have not found anything left to separate them beyond the usually somewhat more elongate shape of specimens coming from the Mediterranean, while those from the Cape Verde and Canary Islands agreed completely with the West India specimens. The only features by which I am able to separate the two undoubted species of Brissus (B. carinatus and B. unicolor) are the proportions of the anterior and posterior pairs of ambulacra, and the striking difference in the course of the fasciole in the anterior part of the test. In Brissus carinatus the posterior ambulacra are much shorter than the anterior pair, while they are nearly equal in B. unicolor. There is but one re-entering angle in anterior part of fasciole in the anterior interambulacra, while there are two in B. carinatus; some minor points of difference in these species will be pointed out hereafter in the descriptions. The outline of the West India specimens is usually elliptical, slightly broader posteriorly; anal extremity vertically truncated, and apex posterior; test sloping very slightly from abactinal system to apex, forming a broad rounded keel, not specially prominent in the posterior interambulacral space. Posterior extremity of the test uniformly tuberculated, while the larger tubercles of the edge of the lower surface extend over the anterior extremity, slightly beyond the anterior pair of ambulacra, and within the peripetalous fasciole, which is narrow, deeply re-entering in the median lower posterior and odd interambulacral spaces.

Lower surface slightly convex; actinal plastron elliptical, terminated by a narrow fasciole, forming a well-defined subanal area, elliptical, deeply indented below the anal system, broader than the actinal plastron. Anal system large, elliptical, composed of one exterior row of large polygonal plates; interior ones smaller and irregularly arranged.

Spines of dried specimens of a yellowish-brown color, comparatively long, especially in the anterior part of the test. Mouth large, longitudinal and transverse diameter nearly as one to two; posterior lip but little prominent.

Genital openings round, close together; posterior ones largest, slightly more distant; madreporic body prominent.

The anterior odd ambulacrum is flush with the test, and is marked by a distinct narrow band of closely crowded small tubercles extending from the abactinal system to the margin of the test between the two rows of large pores forming the odd ambulacrum.

In smaller younger specimens we find the broad rounded posterior keel less well defined, the anal system comparatively much larger, the subanal plastron more elliptical, and the tubercles of the anterior extremity proportionally much less prominent. Mouth comparatively more circular, ratio of transverse to longitudinal diameter being two to one and a half.

Littoral.

Long. Diameter.	Transverse Diameter.	Height.	Ant. Pair Amb.	Post. Pair Amb.	Breadth of Actinal Plastron.	Breadth of Subanal Area.
83	69	46.	28.	37.	37.5	35.4
64	51	38.5	21.5	26.5	28.	24.
52	39	27.	14.5	17.6	19.1	16.3
39	29	21.5	12.	14.5	14.1	15.9
28	21	14.	7.2	9.2	10.	13.

(BRISSUS.) MEOMA.

Meoma GRAY, 1851. Ann. Mag. N. H.

Shell moderately stout, heart-shaped; ambulacra (except odd one) sunk in deep groove, the anterior and posterior pair nearly equal; anterior ambulacrum indistinct. Peripetalous fasciole sinuous; subanal fasciole more or less imperfect, usually extending to the level of anal system as an open curve.

Meoma ventricosa

! *Spatangus* **ventricosus** LAMK. 1816. An. s. Vert.
! *Meoma ventricosa* LÜTK. 1864. Bid. til Kunds. om Echin.

Pl. XX. f. 8; Pl. XXII. f. 3, 4.

Test moderately stout, broadly elliptical, slightly heart-shaped from above. Actinal surface, with the exception of the projecting posterior lip of the actinostome, flat; anal extremity obliquely truncated towards sloping actinal surface; regularly arched from the edge of the test to the apex; apex anterior, corresponding nearly with the abactinal centre; regularly arched from anal and

anterior extremity to apex, lateral ambulacra deeply sunken, posterior pair somewhat longer than anterior pair, which diverges at a much greater angle from the scarcely marked odd anterior ambulacrum; this is placed in a very slightly marked anterior groove. Peripetalous fasciole of uniform breadth, well defined, four genital openings diverging posteriorly. On the interambulacral plates, enclosed by the fasciole, the tubercles are arranged in single rows parallel to the suture; the rest of the test is covered by closely packed, uniform-sized tubercles, carrying short, sharp spines. The tubercles of the actinal part of the test are larger immediately adjoining the ambulacra, diminishing in size towards the edge and towards the central part of the actinal plastron. This plastron is bottle-shaped, short-necked, near the actinostome, with a very indistinct keel near the central portion, bounded posteriorly by the narrow, usually open, subanal fasciole, the anal extremity of which is bent near the base of the anal system. The actinostome is deeply sunken, the posterior lip extremely prominent and projecting almost as far as the anterior edge of the actinostome. The anal system is small, elliptical, covered by irregular polygonal plates carrying spines, diminishing rapidly in size towards the anal opening. The edge of the interambulacra adjoining the ambulacral plates of the lower side, the space round the anal system and round the actinostome, is closely crowded with two kinds of pedicellariæ, one with short head, broad base, and short arms, the other with long triangular arms. Both are carried upon moderately long, stout stems.

A small specimen of Meoma, not measuring quite an inch in length, which D'Orbigny had described as Schizaster cubensis, showed no special points of difference from the adult.

Lütken first referred this species to the genus Meoma of Gray, established for a presumed Australian species, M. grandis. Lütken also, in 1863, called my attention to the generic identity of *Kleinia* **nigra**, A. Ag., with Meoma, which I had with doubt referred to Kleinia. This mistake I was led into by the fact that Gray himself did not refer Brissus ventricosus to Meoma, but still retained it in a section of Brissus. This shows how little value the subdivisions which Gray so frequently introduces in his genera of Echini must have (often copied without any attempt at a more accurate discrimination of the species from similar headings in the Catalogue Raisonné), when two species as closely allied as Meoma ventricosa and Meoma grandis are placed in two genera; or when in the subdivisions of Echinocardium, as another instance, Echinocardium ovatum is placed in the subdivision of the genus

with "*deep, odd ambulacral groove*," instead of being placed in the same subdivision as E. mediterraneum. The genus Kleinia I am unable from Gray's specimens to distinguish from Brissopsis. **Meoma grandis** GRAY, from a careful comparison of the originals of Gray, I consider as identical with Meoma nigra (*Kleinia* **nigra** A. AG.). The locality quoted by Gray is undoubtedly erroneous, Captain Belcher, as Lütken mentions in his "Bidrag," having visited Central America; and the fact that we have in the British Museum, brought back by Belcher, an *Agassizia* **subrotunda** GRAY, **Meoma grandis** GRAY, and an *Echinanthus* **testudinarius** GRAY, marked "Australia," neither of which can be distinguished from Agassizia ovulum, Meoma nigra, and Clypeaster speciosus, found upon the west coast of Central America, seems to indicate without much doubt an error in the localities of the specimens of Gray's Catalogue.

Littoral to 85 fathoms.

(BRISSUS.) METALIA.

Metalia GRAY. 1855. Cat. Rec. Ech. (emend.)

The subgenera Plagionotus and Metalia are united as a single subgenus of Brissus (Metalia). The slight differences in the course of the peripetalous fasciole and the presence of larger tubercles not being sufficient ground, with our present knowledge of the changes due to growth, to warrant retaining them both, and as Plagionotus is already in use among Coleoptera, the subgenus proposed by Gray has been adopted and emended to include Brissidae having a more or less broad, elliptical, or undulating re-entering peripetalous fasciole, and an anterior ambulacral groove. Lateral ambulacral petals narrow, elongate; pores well separated; apex anterior; actinal plastron narrow, heart-shaped; subanal area bordered by a broad fasciole, with anal branches connected with it; subanal ambulacral pores sending radiating grooves towards the centre of the subanal area. Actinostome anterior, crescent-shaped. Tuberculation in the peripetalous fasciole coarse, frequently consisting of primary tubercles. Spines short, slender, curved; those of actinal surface longer, curved, broad at base of milled ring. Haime suggested the propriety of uniting Eupatagus with Plagionotus, but as Desor justly notices, the difference in structure of the ambulacra shows that they have only superficial characters in common, Eupatagus being closely allied to Spatangus, and not to Brissus, as is the case with Plagionotus.

Metalia pectoralis

Echinus **grandis** GMEL. 1788. LINN. Syst. Nat.
† *Metalia pectoralis* A. AGASS. 1872. Rev. Ech., Pt. I.

Pl. XXI. f. 4, 5.

The specimens of this species usually preserved in museums are almost invariably denuded tests, and we have therefore a very imperfect idea of the natural features of this fine Spatangoid. The few spines still remaining on one of the specimens I have seen, corresponding to the small tubercles covering the test, are quite short, greatly curved; those of the large tubercles within the peripetalous fasciole I have not seen. On a small specimen, part of the spines of the actinal side are still left; they resemble the spines of Lovenia, are long, slender, strongly curved eccentrically near the broad base, so that we may assume that the spines of the large dorsal tubercles were probably of the same structure. The test is thin, more or less elliptical, though with increasing size the edge becomes somewhat angular, the median interambulacral spaces re-entering slightly. The outline in profile is regularly arched in small specimens, but in older ones we frequently find a gradual sloping of the test from the edge to the apex, others retaining the more regularly arched outline. The vertex is anterior, corresponding to the abactinal system. The odd anterior ambulacrum is placed in a slight groove. The anterior pair of ambulacra are shorter than the posterior, — the anterior slightly curving anteriorly, the posterior diverging, on the contrary, at the extremity. The peripetalous fasciole is broad, sometimes sunken, somewhat elliptical, except the anterior angle made previous to crossing the odd ambulacrum. A slight ridge extending to the apex divides the anterior interambulacrum into a portion bearing large tubercles next to the anterior pair of ambulacra, and into the part adjacent to the odd ambulacrum, where the primary tubercles are numerous but small. The whole space of the lateral interambulacrum above the peripetalous fasciole is crowded with large primary tubercles with a broad scrobicular circle, except the part immediately adjoining the posterior edge of the anterior ambulacra, which is divided by a slight ridge from the remaining part of the interambulacral space. The same is the case with the narrow posterior interambulacral space; a ridge separates the space free of tubercles adjoining the posterior edge of the posterior ambulacrum from that covered by tubercles; the tubercles of the odd posterior interambulacrum are smaller than those of the lateral posterior ambulacra, where the primary tubercles take the greatest development. The difference between the length of

the lateral ambulacra is less marked in young specimens. The anal system is placed in a depression in the obliquely truncated posterior extremity of the test; it is pear-shaped, the small end turned towards the abactinal pole, often rising above the edge of the test. The plates covering the anal system are irregular, nearly of uniform size; the plates covering the membrane immediately surrounding the anal opening are minute, occupying the greater part of the actinal portion of the anal system; in the smallest specimen measured the posterior extremity is truncated vertically, there being but a slightly marked anal depression, which becomes afterwards so prominent with advancing age as to form in large specimens cheeks on each side of this depression at the angle of the subanal fasciole and the anal branch. The whole upper surface of the test is covered by minute tubercles, forming a regular granulation below the peripetalous fasciole to the edge of the test. Above the fasciole the tubercles are slightly larger and more distant, especially when forming the scrobicular circle round the primary tubercles. The genital openings are circular, diverging posteriorly, with prominent comma-shaped madreporic body extending into the posterior interambulacrum.

The actinal plastron is elongate, narrow, with a marked keel at the posterior extremity extending to the base of the broad, heart-shaped subanal plastron, has four pores, completely surrounded by a broad fasciole, lobed internally. The anal fasciole is independent of the subanal, being separated from it by an extremely narrow ridge of minute tubercles; the horizontal part is broad; the upper branches narrow, and extend to the edge of the test. The tubercles of the actinal surface are largest outside of the ambulacral rows, gradually decreasing towards the edge of the test; the tubercles of the actinal plastron are considerably smaller, and more closely packed. In large specimens the suture of the plates on the upper part of the test are slightly sunken, the plates themselves sloping from a vertex or ridge towards the edges, — a feature not prominent in younger specimens, thus forming ridges dividing the interambulacrum into distinct fields. The fine figure of this species given by Seba is one of the best which can be given, and will serve, as many of his figures do now, to readily identify many species of Echini. The mouth is comparatively narrow transversely, distinctly rounded anteriorly, with a straight, raised posterior edge. The actinal membrane is covered by polygonal plates, closely crowded, except the anterior row of plates, which is the largest, decreasing gradually to the posterior edge.

The identity of the pliocene and post-pliocene species cited in the synonymy

of this as well as of others of our Eastern Coast species, is of course problematical; yet the differences indicated by McCrady do not indicate as great a range of variation as we find in living species. I have quoted the figures for the sake of calling attention to them. There are, in addition, other tertiary species described by Michelin and by Guppy, coming from the Gulf of Mexico and the West India Islands; but as their material was inaccessible to me, I have not attempted to point out their affinities.

Littoral and fragments from 115 fathoms.

Width of Mouth.	Longitudinal Diameter.	Transverse Diameter.	Height.	Anterior Pair Amb.	Posterior Pair Amb.	Distance of Mouth from Ant. Extremity.	Distance of Vertex to Anterior Extremity.	Breadth Actinal Plastron.
19.5	157.	123.8	58	51.	62.5	33.	57.	29.
16.5	130.5	96.	40	39.2	53.	25.8	49.8	19.2
18.7	116.	91.	44	39.	52.2	24.	41.	21.8
9.5	62.	46.	27	16.2	21.8	14.	20.5	13.5

SCHIZASTER.

Schizaster AGASS. 1836. Prod.

Test thin, elongate; apex posterior; great difference between length of anterior and posterior pairs of ambulacra. The anterior ambulacrum placed in a deep, broad groove; anterior and posterior petals somewhat sunken and diverging; the anterior are nearly parallel with anterior groove. Genital pores varying in number from two to three. Peripetalous fasciole angular, running close to the ambulacral petals, with a narrow lateral fasciole starting from the anterior ambulacra and passing under the anal system, with elongate, triangular swellings. Posterior lip of bilabiate actinostome very prominent, turned back, rising to a rounded beak in front of actinal plastron.

Schizaster fragilis

! *Brissus* **fragilis** DÜB. & KOR. 1844. Skand. Echin.
! *Schizaster fragilis* AGASS. 1847. C. R. Ann. Sc. Nat.

Pl. XXI. f. 3.

Test depressed, vertex and apical system almost coinciding; three genital openings, right anterior obliterated. Compared with S. canaliferus, the odd ambulacral groove is less broken and narrower; the pores arranged in a most regular line; the pores of each pair separated by prominent, elongate tubercles, making a beautiful line of beads from the apex to the peripetalous fasciole, the flat space intervening between the poriferous zones being covered by small tubercles and granules of little prominence, except the outer rows near the poriferous zone; the lateral ambulacra are but slightly sunken,

the anterior and posterior both diverging more than is the case in S. canaliferus, and the posterior ambulacra are proportionally longer. The posterior genital openings are distant, the madreporic body well developed between them, extending posteriorly. The peripetalous fasciole widens into a broad, triangular space at the extremity of the anterior ambulacra, extends straight across from tip to tip, the two posterior ambulacra making quite a re-entering angle between the anterior and posterior lateral ambulacra. Lateral fasciole running parallel to the ambitus. Outline of the test from above is somewhat diamond-shaped, with rounded angles. Seen in profile, the test tapers very gradually towards the actinostome posteriorly, regularly arched to the anal system; posterior extremity abruptly truncated, receding below the anal system; the subanal fasciole runs in a curve under the anus in a depression between the projecting cheeks of the adjoining ambulacral plates, — a condition of things in striking contrast with the prominent keel formed at the extremity of the actinal plastron by the angular exterior of the subanal fasciole in S. canaliferus. Actinal side flat, with broad bare ambulacral zones; actinal plastron elliptical, posterior extremity not well defined, losing itself in the tubercles of the test under the subanal fasciole.

Anal system covered by a large number of small plates carrying each a small spine.

The spines of the upper part of test are short, spathiform; tuberculation larger towards the anterior extremity and near the ambulacra, size of spines corresponding to this. The tubercles of the lower side are far apart near the edge of the test and of the ambulacral zones; those of the actinal plastron are closely crowded, while adjoining the anterior groove they become very prominent.

The fragments of Schizaster found by Mr. Pourtalès were referred to in the Preliminary Report as Schizaster cubensis. Having since that time received specimens of Schizaster fragilis from Dr. G. O. Sars and Professor Thomson, there can be no doubt that the fragments belong to this species, as they are the greater portion of the anterior part of the test. An examination of the original specimens of D'Orbigny's S. cubensis shows them to be young Meoma ventricosa.

Mr. Whiteaves has dredged specimens of this species in 250 fathoms in the Gulf of St. Lawrence.

80 fathoms, fragments.

Longitudinal Diameter.	Transverse Diameter.	Height.	Distance of Vertex to Posterior Extrem.	Posterior Ambulacra.	Anter. Pair Ambulacra.	Actinal Plastron.
55	58	32	24.5	9.5	25.1	20
51	51	29	21.5	8.	23.	19

MOIRA.

Moira A. Agass. 1872. Rev. Ech. Pt. I.

Test moderately thin, ovoid; ambulacral petals sunken; test bulging towards interior in five pouches from five narrow deep grooves, like radiating spokes from the abactinal pole, edged by the peripetalous fasciole which forms round them a smooth border. Lateral fasciole passing at a considerable distance under the anal system, as in Agassizia and Schizaster; tubercles arranged upon the upper surface diagonally. Actinal plastron elongated, pentagonal, covered by larger tubercles, with ill-defined scrobicular circle carrying spathiform spines; only two posterior genital openings. Anterior groove extending to actinostome.

Gray has subdivided Schizaster into three genera, following the three types of the Catalogue Raisonné; he has, however, retained for S. atropos the name of Schizaster, and separated the closely allied species S. canaliferus and S. gibberulus, placing them respectively in the genera Brisaster and Nina. The subdivisions of Michelin made at the same time, more in accordance with the affinities of the species, are retained here. To distinguish this genus from the same generic name previously used by Leach and Huebner, I have changed the name to **Moira**:—

Moira atropos

! *Spatangus* **atropos** Lamk. 1816. An. s. V.
! **Moira** *atropos* A. Agass. 1872. Rev. Ech. Pt. I.

Pl. XXIII.

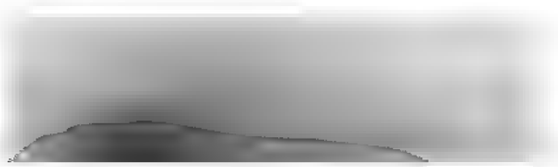
Outline from above elliptical (*Pl. XXIII. f. 1, 5*); when denuded of spines, slightly angular near junction of interambulacral plates. The plates of test are all somewhat conical (*Pl. XIII. f. 6*), resembling shield plates of turtles rising slightly towards one side and tapering towards the edge; from their highest point the tubercles radiate irregularly towards the edge. The angular outline increases greatly with age, and in older specimens this feature becomes quite prominent, while in younger specimens the tendency is to be more and more ovoid. Part of the posterior edge of the apical part of the anterior ambulacra projects over the anterior edge, completely closing the upper portion of the anterior lateral ambulacra (*Pl. XXIII. f. 5*). It then recedes again, and the ambulacral groove thus appears to commence at a distance from the apex and make a marked angle with the longitudinal axis.

The odd anterior ambulacrum is divided, by the closing up of the slightly sunken edge of the abactinal part of the edge of the anterior groove, into two connected cavities. When seen from above, the projecting lips form two triangular spaces (*Pl. XXIII. f. 5*), closely covered by small tubercles, to the anterior edge of which the peripetalous fasciole extends, and then passes on to the edge of the lateral ambulacra. The anterior lateral ambulacra are much longer than the posterior. The vertex is situated slightly behind the apical system; the posterior extremity is truncated vertically, making a sharp angle with the actinal plastron, which has, immediately below the subanal fasciole, a small, fully developed keel (*Pl. XXIII. f. 4*). The anal system is flush with the test, small, elliptical, edged by eight large plates surrounding the smaller interior ones. The lateral fasciole is narrow, becoming slightly broader under the anal system; the part of fasciole adjoining the deep groove is broad; the connecting parts between the petals are narrow. Seen in profile, the anterior edge is gradually rounded from the vertex to the ambitus, the same curve of the test extending to the mouth (*Pl. XXIII. f. 2*).

Fragments of this species were dredged from a depth of 80 fathoms. Girard has attempted to separate specimens from Texas, of slightly more elongate outline, as a distinct species. The color of M. atropos when alive is yellowish. The spines, where more thickly clustered, are brownish; they are short except where they cover the sunken ambulacra, which are entirely hidden by the longer spines meeting from both sides. On the lower surface, the interambulacral plastron is covered by long spines, which, as they wear out at the extremity, become spatula-shaped. On the side of the ambitus, and on the upper lateral part of the posterior ambulacra, the spines attain a greater length, especially towards the mouth, where they are most closely crowded together.

Littoral to 80 fathoms.

Longitudinal Diameter.	Transverse Diameter.	Height.	Length Posterior Ambulacra.	Length Anterior Ambulacra.	Distance of Lip Anterior Amb. from Vertex.	Height of Anus above Actinal Surf.
47.	44.	37.5	14.2	24.8	10.1	14.
42.	42.	31.2	13.0	21.	8.8	11.8
30.8	30.5	26.	10.0	18.	6.	8.9
22.5	21.	18.2	7.0	13.	5.	8.



BATHYMETRICAL AND GEOGRAPHICAL DISTRIBUTION.

The accompanying table (pp. 368 and 369) shows at a glance the principal features of distribution of the different zones of depth. We can distinguish a strictly littoral fauna, extending from tide-mark to generally less than 10 fathoms, though a few of the species characteristic of this zone extend to a depth of 34 and 40 fathoms. This fauna consists of

Diadema setosum.
Echinometra subangularis.
Echinometra viridis.
Toxopneustes variegatus.
Hipponoë esculenta.
Echinanthus rosaceus.
Clypeaster subdepressus.
Mellita testudinata.
Encope Michelini.
Encope emarginata.
Echinonëus semilunaris.
Brissus unicolor.

A second set of species, less numerous, extends from the shore to a much greater depth, — from 80 to about 120 fathoms. They are

Cidaris tribuloides.
Arbacia punctulata.
Meoma ventricosa.
Metalia pectoralis.
Moira atropos.

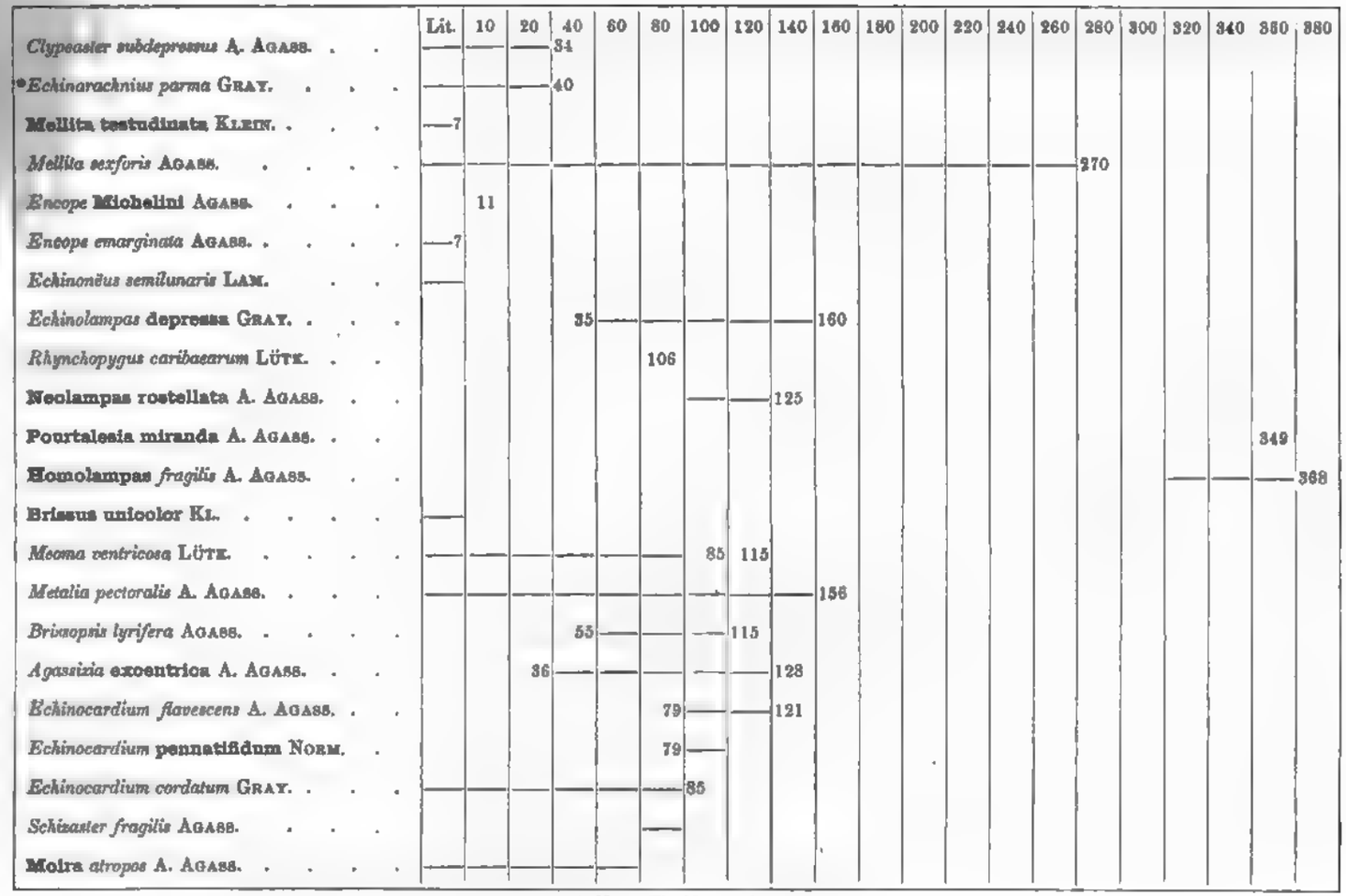
At a depth of from 30 to 40 fathoms commences a third set of species, the majority ranging to about 160 fathoms, though two species range to 270 fathoms (marked *), and a few species commence at a greater depth, 80 to 90 fathoms. These species are

* Dorocidaris papillata.
Echinus gracilis.
Temnechinus maculatus.
* Trigonocidaris albida.
Rhynchopygus caribaearum.
Echinolampas depressa.
Neolampas rostellata.
Brissopsis lyrifera.
Agassizia excentrica.
Echinocardium flavescens.
Echinocardium pennatifidum.
Echinocardium cordatum.
Schizaster fragilis.

NOTE. — Figures denote depth in fathoms; range of a species is indicated by the horizontal lines; thus, 138———270 in Hemipedina shows its range from 138 to 270 fathoms. Figures at head of column to be taken, where no others are given.

	Lit.	10	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380
Cidaris tribuloides Bl.								116													
Dorocidaris *papillata* A. Agass.																270					
Salenia carispina A. Agass.																		315			
Diadema setosum Gray.			17																		
Asthenosoma hystrix A. Agass.									138												
Hemipedina cubensis A. Agass.									138							270					
Arbacia *punctulata* Gray.									125												
Podocidaris sculpta A. Agass.									138									315			
Coelopleurus **floridanus** A. Agass.										160											
Echinometra subangularis Desml.	7																				
Echinometra **viridis** A. Agass.	7																				
*Strongylocentrotus *Drōbachiensis* A. Agass.																					
Echinus **gracilis** A. Agass.							93														
Echinus **norvegicus** D. K.												195									
Temnechinus maculatus A. Agass.			30																		
Trigonocidaris albida A. Agass.																270					
Toxopneustes variegatus A. Agass.				34																	
Hipponoë esculenta A. Agass.																					
Echinanthus rosaceus Gray.	5																				
Echinocyamus pusillus Gray.																			325		

* Not a Florida species.



* Not a Florida species.

At a depth of about 140 fathoms, extending to over 310 fathoms, are found most interesting species: —

Hemipedina cubensis.
Podocidaris sculpta.
Echinus norvegicus.

While near the lowest depth reached by the above species we strike upon a peculiar fauna recalling types of the cretaceous period, extending from 315 fathoms to the greatest depth attained in the straits between Florida and Cuba. These are

Salenia varispina.
Pourtalesia miranda.
Homolampas fragilis.

Two species — Echinocyamus pusillus and Mellita sexforis — have the greatest bathymetrical range, extending from the shore, the one to 270 fathoms and the other to 325 fathoms. I would state, however, that it is only the young which have this great range; the adult specimens are limited to a quite shallow zone, — about 40 fathoms. In the young of our common northern Cuvieria the reverse takes place, the young being quite common at low-water mark, while young Echinarachnius and S. Dröbachiensis are found at a much greater depth than the adult.

I have given the greatest depth of living young, as the dead tests may have been dropped by fishes or carried by currents. The character of the Echinian fauna, on the three belts developed by the soundings of Mr. Pourtalès, are tolerably well defined; the first zone being littoral, and extending to 90 fathoms, is characterized by species, the majority of which do not range beyond 40 fathoms, with a few species ranging somewhat beyond, to about 120 fathoms.

The second zone (from 90 to 250 fathoms) is characterized by species extending into the first somewhat, and attaining a range of about 270 fathoms, with an admixture of a few species extending from 140 to 310 fathoms.

The third zone contains the typical deep-sea species of Florida, extending from 315 to 500 fathoms.

Although we have not a sufficient number of soundings to establish homogeneous zones of geographical and bathymetrical range, an analysis of the above grouping of species shows us something analogous to the distribution of animal and vegetable life in latitude and height; the oceanic distribution

being of course an identity for northern latitudes and southern depth, or a representation by species closely allied.

For instance, we find littoral, as far north as North Carolina, Moira atropos and Echinocardium cordatum; Arbacia punctulata, as far north as the southern part of Cape Cod, species which in Florida have a range in depth to 125 fathoms. Of their bathymetrical range farther north we know nothing.

The following North European species, Dorocidaris papillata, Schizaster fragilis, Echinus norvegicus, Echinocardium flavescens, E. cordatum, Echinocyamus pusillus, Brissopsis lyrifera, Asthenosoma hystrix, are found in Florida. These same species, with the addition of Brissus unicolor, Echinocardium pennatifidum, Diadema setosum, and Arbacia punctulata, are again the representatives of a Mediterranean fauna strikingly similar, consisting of Schizaster canaliferus, Echinus melo, Echinocardium mediterraneum, Centrostephanus longispinus, Arbacia pustulosa. The specific representation on both sides of the Isthmus of Panama is becoming every day, as far as Echinoderms are concerned, more strikingly identical. Since the list given by Mr. Verrill, several species have come to light, and the following comparative list (p. 372) of species on both sides of the Isthmus, extending from Peru to the Gulf of California on the Pacific, and including on the eastern side the Gulf of Mexico, Florida, the northern coast of South America, the West Indies, and the Bahamas, may not be out of place. (I have examined all the species there named.) As this list will undoubtedly be greatly increased by additional dredging from the Hassler Expedition, it is given as published in the Preliminary Report, and no attempt has been made to re-examine the question of the specific identity of any of the Echini on the Atlantic and Pacific sides of the Isthmus of Panama.

With the exception of three Panama species, all the West Coast species have representatives on the Eastern Coast. The Eastern species which have not as yet been found represented on the West Coast are the deep-water species of Mr. Pourtalès's collection, and, what is very peculiar, three species, Echinonëus semilunaris, Echinocardium cordatum, and Echinolampas, belonging to genera which have a most extensive range.

The relation of the Caribbean fauna to the existing geographical distribution of Echini is shown by the accompanying faunal table, page 373, and the maps of Part I. *Plates A – G.*

Eastern Side. (*Tropical Atlantic.*)	Western Side. (*Panamic*).
Cidaris tribuloides Bl.	*Cidaris* **Thouarsii** Val.
Dorocidaris *papillata* A. Agass.	
Salenia varispina A. Agass.	
Diadema setosum Gray.	*Diadema* **mexicanum** A. Agass.
	Astropyga pulvinata Agass.
Asthenosoma hystrix A. Agass.	
Hemipedina cubensis A. Agass.	
Arbacia *punctulata* Gray.	**Arbacia** *stellata* Gray.
Podocidaris sculpta A. Agass.	
Coelopleurus **floridanus** A. Agass.	
Echinometra subangularis Desml.	*Echinometra* **Van Brunti** A. Agass.
Echinometra **viridis** A. Agass.	
	Strongylocentrotus mexicanus A. Agass.
Echinus **gracilis** A. Agass.	
Echinus **norvegicus** D. & K.	
Temnechinus maculatus A. Agass.	
Trigonocidaris albida A. Agass.	
Toxopneustes variegatus A. Agass.	*Toxopneustes semituberculatus* A. Agass.
	Toxopneustes *pileolus* Agass.
Hipponoë esculenta A. Agass.	*Hipponoë depressa* A. Agass.
Echinanthus rosaceus Gray.	*Echinanthus* **testudinarius** Gray.
Clypeaster subdepressus Agass.	*Clypeaster rotundus* A. Agass.
Echinocyamus pusillus Gray.	
Mellita testudinata Kl.	*Mellita* **longifissa** Mich.
Mellita sexforis A. Agass.	*Mellita* **pacifica** Verrill.
	Mellita Stokesii A. Agass.
	Encope **californica** Verrill.
Encope **Michelini** Agass.	**Encope grandis** Agass.
Encope emarginata Agass.	*Encope* **micropora** Agass.
Echinonëus semilunaris Lam.	
Echinolampas **depressa** Gray.	
Rhynchopygus caribaearum Lütk.	*Rhynchopygus pacificus* A. Agass.
Neolampas rostellata A. Agass.	
Pourtalesia miranda A. Agass.	
Homolampas *fragilis* A. Agass.	
	Lovenia **cordiformis** Lütk.
Brissus unicolor Kl.	*Brissus* **obesus** Verrill.
Meoma ventricosa Lütk.	**Meoma grandis** Gray.
Metalia pectoralis A. Agass.	*Metalia maculosa* A. Agass.
Brissopsis lyrifera Agass.	
Agassizia **excentrica** A. Agass.	**Agassizia scrobiculata** Val.
Echinocardium flavescens A. Agass.	
Echinocardium **pennatifidum** Norm.	
Echinocardium cordatum Gray.	
Schizaster fragilis Agass.	
Moira *atropos* A. Agass.	**Moira** *clotho* A. Agass.

EASTERN SIDE OF ISTHMUS. (*Tropical Atlantic.*)	Panamic.	North Atlantic.	Lusitanian.	West African.	Indo-Pacific.	Japanese.	Patagonian.
Cidaris tribuloides Bl.	*			i	*		
Dorocidaris *papillata* A. Agass.		i	i		*		*
Salenia varispina A. Agass.							
Diadema setosum Gray	*	i	i	i	i		
Asthenosoma hystrix A. Agass.		i	i			*	
Hemipedina cubensis A. Agass.						■	
Arbacia *punctulata* Gray	*		i	i			*
Podocidaris sculpta A. Agass.							
Coelopleurus **floridanus** A. Agass.					*		
Echinometra subangularis Desml.	*		i	i	*	*	
Echinometra **viridis** A. Agass.					*		
Echinus **gracilis** A. Agass.		*	*				
Echinus **norvegicus** Düb. o. Kor.		i	i				■
Temnechinus maculatus A. Agass.			i			*	
Trigonocidaris albida A. Agass.						*	
Toxopneustes variegatus A. Agass.	*				■		
Hipponoë esculenta A. Agass.	■				*	*	
Echinanthus rosaceus Gray	*				*	*	
Clypeaster subdepressus Agass.	*			■	*	■	
Echinocyamus pusillus Gray		i	i				
Mellita testudinata Kl.	■						
Mellita sexforis A. Agass.	*				*?		
Encope **Michelini** Agass.	*						
Encope emarginata Agass.	*						
Echinonéus semilunaris Lam.					*		
Echinolampas **depressa** Gray				*	■		
Rhynchopygus caribaearum Lütk.	*						
Neolampas rostellata A. Agass.							
Pourtalesia miranda A. Agass.		i	i				
Homolampas *fragilis* A. Agass.			i				
Brissus unicolor Kl.	■		i		i	i	
Meoma ventricosa Lütk.	*						
Metalia pectoralis A. Agass.	*			■	*	■	
Brissopsis lyrifera Agass.		i	i		■		*
Agassizia **excentrica** A. Agass.	*						
Echinocardium flavescens A. Agass.		i	i				
Echinocardium **pennatifidum** Norm.		i	*				
Echinocardium cordatum Gray		i	i			*	
Schizaster fragilis Agass.		i	*		*		
Moira *atropos* A. Agass.	*				*		

Note.—*i* denotes identity of species; * denotes representative species.

We have in Temnechinus maculatus and Trigonocidaris albida representatives of the Temnopleuridae, thus far limited almost entirely to the Indian and China Seas. The littoral species having the most limited bathymetrical range are those which have the widest geographical distribution. They are Diadema setosum, Cidaris tribuloides, Clypeaster subdepressus, Echinometra subangularis, Toxopneustes variegatus, Mellita testudinata, Encope emarginata. Some of these species extend from the southern part of Brazil to the Bermudas. They all belong to genera having representatives in the great tropical belt surrounding the globe, formed by the Indo-Pacific, Lusitanian, West African, Tropical Atlantic, and Panamic districts, — such as Cidaris, Diadema, Echinometra, Hipponoë, Clypeaster, Echinanthus, Echinolampas, Echinonëus, Brissus, — the species of which have a great geographical range, and are represented by the following species: Cidaris metularia, Hipponoë variegata, Echinometra lucunter, Diadema setosum, Clypeaster humilis, Echinolampas oviformis, Echinonëus cyclostomus, Brissus carinatus; all of which have an immense geographical distribution.

The precise range of the different species of the East Coast will be found in Part I, in the Synonymy and in the General Lists of the Geographical Distribution.

SYSTEMATIC TABLE

OF THE ECHINI OF THE EASTERN COAST OF THE UNITED STATES.

Suborder DESMOSTICHA, HAECKEL.

Family **CIDARIDAE**, MÜLL.

Subfamily **GONIOCIDARIDAE**, HAECKEL.

Cidaris KLEIN.
Cidaris tribuloides BL., 253.

Dorocidaris A. AGASS.
Dorocidaris *papillata* A. AGASS., 254.

Subfamily **SALENIDAE**, AGASS.

Salenia GRAY.
Salenia varispina A. AGASS., 261.

Family **ARBACIADAE**, GRAY.

Arbacia GRAY.
Arbacia *punctulata* GRAY, 263.

Podocidaris A. AGASS.
Podocidaris sculpta A. AGASS., 269.

Coelopleurus AGASS.
Coelopleurus **floridanus** A. AGASS., 267.

Family **DIADEMATIDAE**, PET.

Asthenosoma GRUBE.
Asthenosoma hystrix A. AGASS., 272.

Diadema SCHYNV.
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Family **ECHINOMETRADAE**, GRAY.

Strongylocentrotus BR.
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Echinometra ROND. (BREYN.).
Echinometra subangularis DESML., 283.
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Family **ECHINIDAE**.

Subfamily **TEMNOPLEURIDAE**, DES.

Temnechinus FORBES.
Temnechinus maculatus A. AGASS., 286.

Trigonocidaris A. AGASS.
Trigonocidaris albida A. AGASS., 289.

Subfamily **TRIPLECHINIDAE**, A. AGASS.

Hemipedina WRIGHT.
Hemipedina cubensis A. AGASS., 291.

Echinus ROND. (LINN.).
Echinus **gracilis** A. AGASS., 293.
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Toxopneustes AGASS.
Toxopneustes variegatus A. AGASS., 298.

Hipponoë GRAY.
Hipponoë esculenta A. AGASS., 301.

Suborder CLYPEASTRIDAE, AGASS.

Family **EUCLYPEASTRIDAE**, HAECKEL.

Subfamily **FIBULARINA**, GRAY.

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Echinocyamus pusillus GRAY, 304.

Subfamily **ECHINANTHIDAE**, A. AGASS.

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Encope AGASS.
Encope emarginata AGASS., 325.
Encope **Michelini** AGASS., 329.

Suborder PETALOSTICHA, HAECKEL.

Family **CASSIDULIDAE**, AGASS.

Subfamily **ECHINONIDAE**, AGASS.

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Subfamily **NUCLEOLIDAE**, AGASS.

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Neolampas A. AGASS.
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Rhynchopygus D'ORBIG.
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Family **SPATANGIDAE**, AGASS.

Subfamily **ANANCHYTIDAE**, ALB. GRAS.

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* The Synonymic Index, Part I., will give the references of the Synonymes to the names adopted here.

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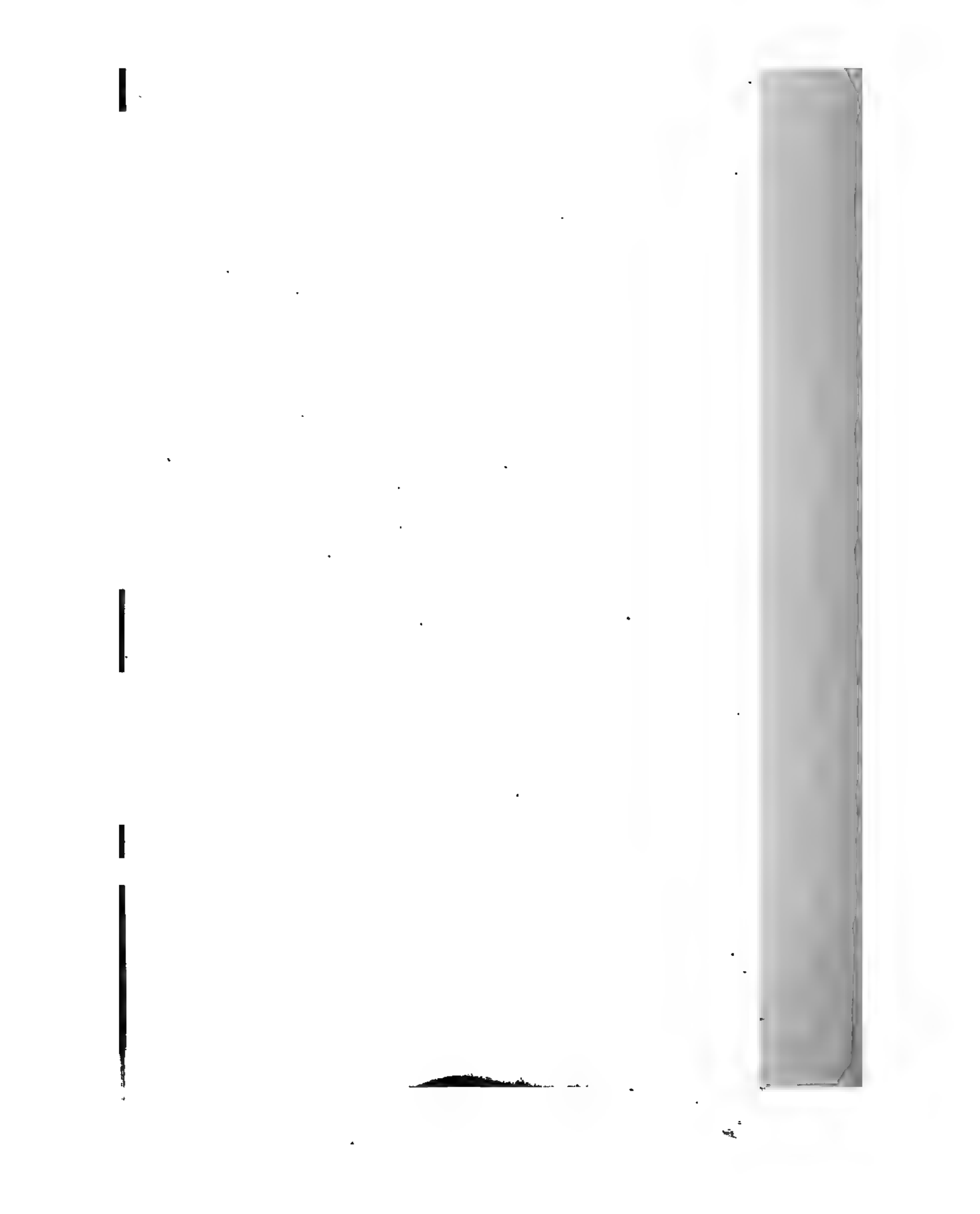

ILLUSTRATED CATALOGUE

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY,

AT HARVARD COLLEGE.

No. VII.

REVISION OF THE ECHINI,

BY

ALEXANDER AGASSIZ.

PLATES.

PARTS I.–II.

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1872.

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PART I.

PLATES A, B, C, D, E, F, G.

PART II.

PLATES I, I^b, I^d, II, II^a, II^b, II^c, III, IV, IV^a, V, VI, VI^a, VII, VIII, IX, X, X^a, XI, XI^a, XI^b, XI^c, XI^d, XIe, XI^f, XII, XII^a, XII^b, XII^c, XII^d, XIII, XIV, XIV^a, XV, XVI, XVII, XVIII, XIX, XX, XXI, XXII, XXIII.

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1872.

PLATE I.

Dorocidaris papillata.

1. Seen from abactinal side, with smooth spines.
2. Somewhat larger specimen, denuded to show abactinal system.
3. Same from the actinal side.
4. Same in profile.
5. Profile of specimen with serrated spines.

(*All figs. natural size.*)

PLATE I^{b}.

Dorocidaris papillata.

Mediterranean. Nat. size.

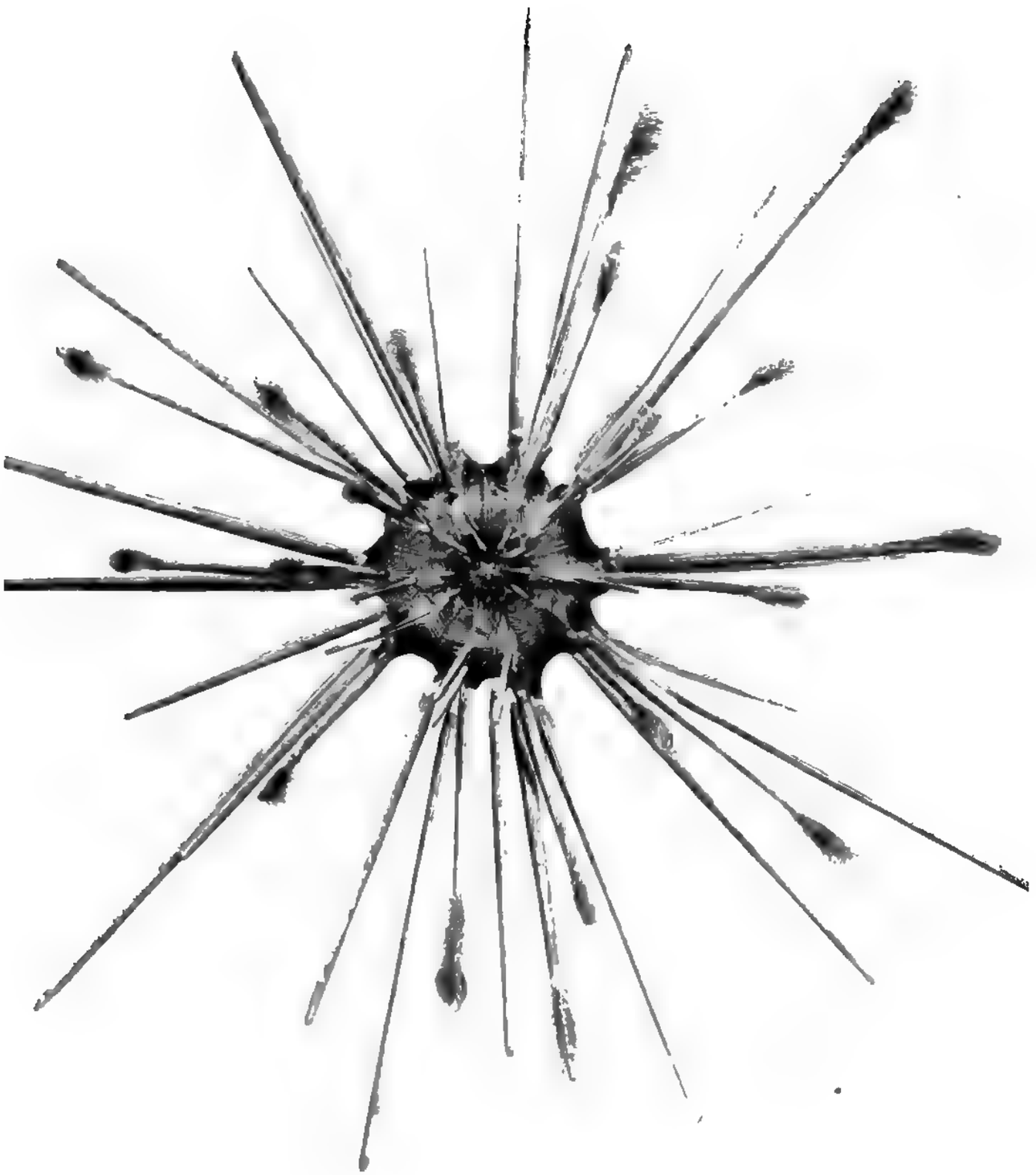
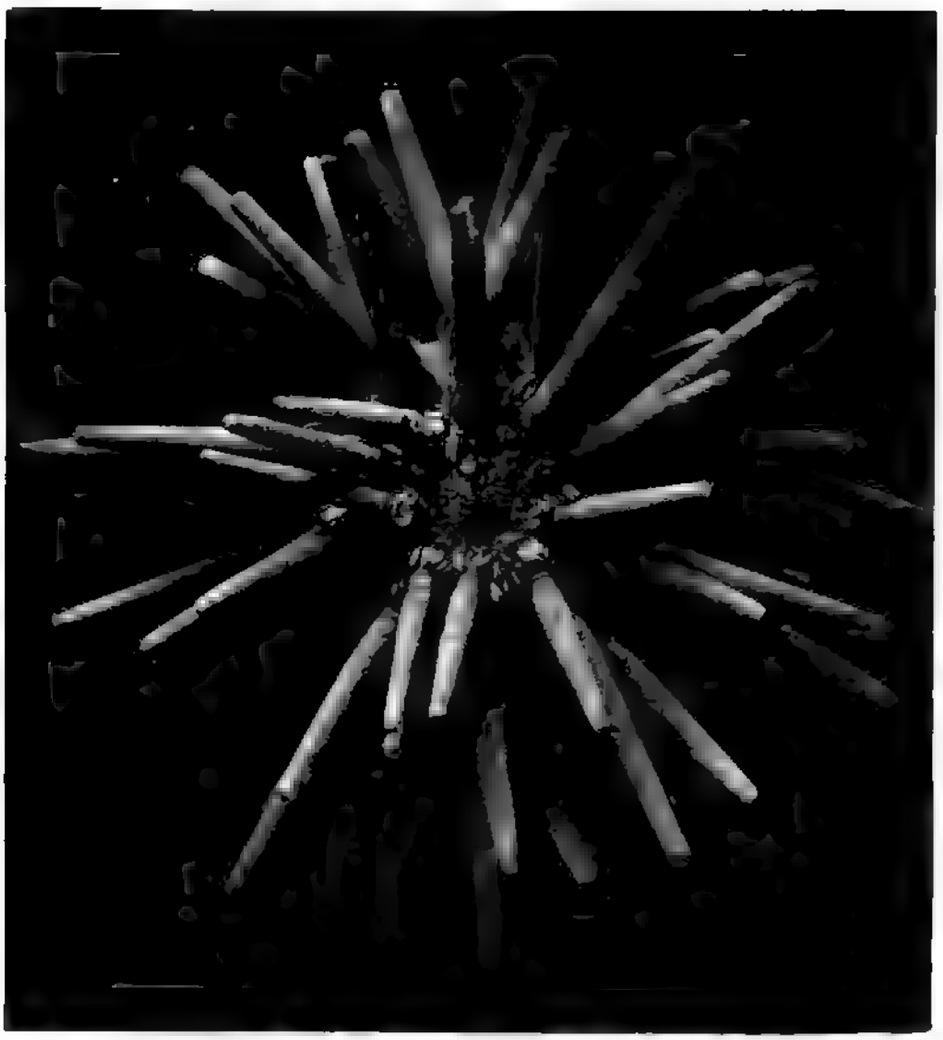


PLATE I[d].

Cidaris tribuloides.

Cape Verde Islands. Nat. size.



A. Forbes, Photo. American Photo-Relief Co., Printers, Phila.

PLATE II.

Cidaris tribuloides, *f. 1–3.*

1. Seen in profile.
2. Seen from the actinal side.
3. Seen from the abactinal pole.

Arbacia punctulata, *f. 4.*

4. Seen from abactinal pole.

Toxopneustes variegatus, *f. 5, 6.*

5. Seen from above.
6. Seen in profile.

(*All figs. natural size.*)

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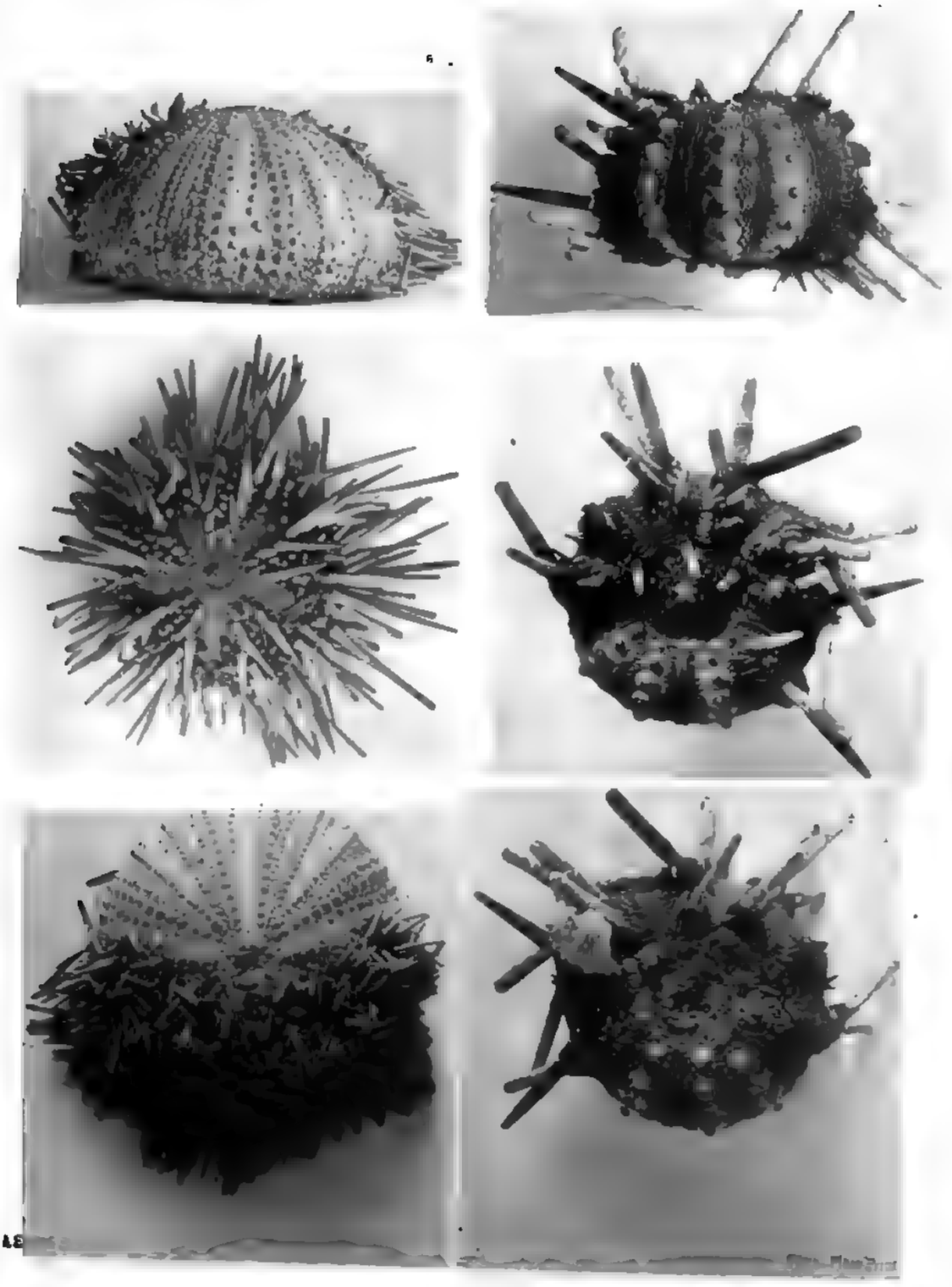


PLATE II[a].

Dorocidaris papillata, *f. 1–15.*

1. Single jaw (pyramid) seen from outside of lantern.
2. Same in profile, showing striation of lateral face.
3. Base of pyramid (inside of lateral face) in profile.
4. " " " from interior of jaw.
5. Pyramid seen from above.
6. Part of upper end of pyramid side plate (exterior.)
7. " " " " " " " " (interior.)
8. Upper part of pyramid in profile.
9. Brace from inside.
10. " " above.
9'. Compass.
11. Tooth seen from outside.
12. " " " within.
13. " " in profile.

Arbacia pustulosa, *f. 15–33.*

15. Single jaw (pyramid) seen from outside.
16. Same from within.
17. Same in profile.
18. " " " interior of lateral face.
19. Pyramid from above.
20. Upper part of pyramid in profile.
21. " " " " " " side plate (exterior.)
22. " " " " " " " " (interior.)
23. Portion of lateral face.
24. Part of tooth from without.
25. Tooth seen from without.
26. " " " within.
27. " " in profile.
28. Brace from above.
29. " " below.
30. " in profile.
31–33. Different views of compass.

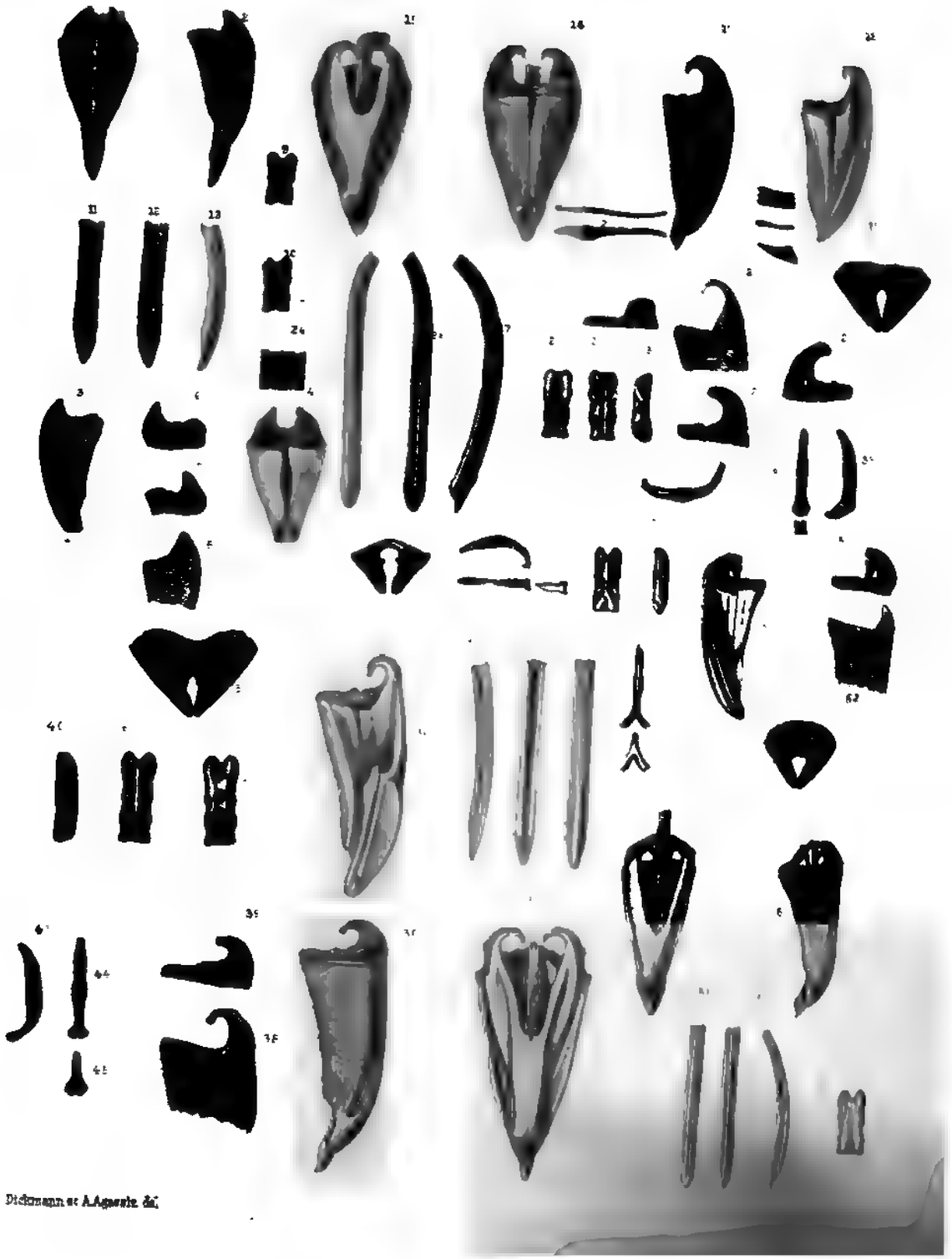
Echinothrix turcarum, *f. 34–48.*

34. Pyramid, interior of lateral face, in profile.
35. " seen from outside.
36. " " in profile.
37. " " from above.
38. Upper part of pyramid.
39. Interior of upper part of pyramid.
40. Brace seen in profile.
41. Brace seen from below.
42. " " " above.
43–45. Compass.
46. Single tooth in profile.
47. " " from inside.
48. " " " outside.

Hipponoë variegata, *f. 49–61.*

49. Single pyramid from without.
50. " " in profile.
51. " " " " interior of lateral face.
52. Part of lateral face.
53. Upper part of pyramid (exterior.)
54. Pyramid from above.
55. Brace from below.
56. Brace in profile.
57. Compass.
58. Single tooth from outside.
59. " " " inside.
60. " " in profile.
61. Brace from above.

(*All figs. of jaws* (*pyramids*) *natural size, others slightly magnified.*)



Dichmann et A.Agassiz del.

PLATE II^{b}.

Dorocidaris papillata, *f. 1–5.*

1. Abactinal system, magnified $1\frac{7}{1}$.
2. Actinal membrane and part of adjoining test showing continuation of the ambulacral system along the imbricated membrane, magnified $1\frac{5}{1}$.
3. Same as fig. 2, seen from the interior of test.
4. Interior view of abactinal system of fig. 1.
5. Interior profile view of part of test, to show auricles, magnified $1\frac{5}{1}$.

Diadema setosum, *f. 6–10.*

6. Abactinal part of test, showing abactinal system, magnified $1\frac{5}{1}$.
7. Same seen from interior of test.
8. Actinal part of test adjoining the actinostome.
9. Same as fig. 8, seen from interior of test.
10. Same seen in profile, to show auricles.

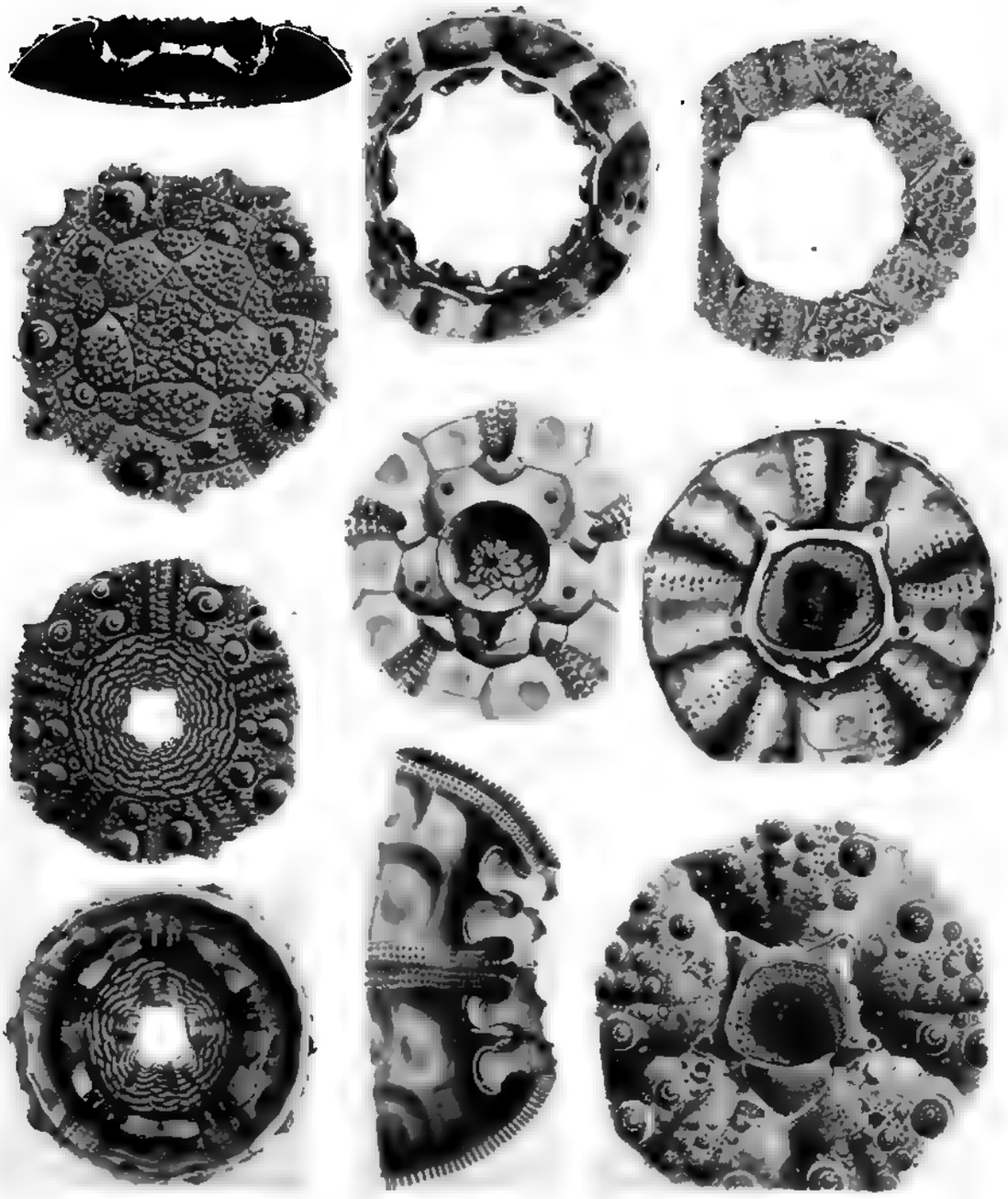


PLATE II^{c}.

Asthenosoma hystrix, *f. 1 – 5.*

1. Part of test of young, from actinal side, 3.1$^{mm.}$ in diam.
2. Same from abactinal side.
3. Spine of the same.
4. Spine of fragment of fig. 5^{a}.
5. Transverse section of same.

5^{a}. Fragment of test of Asthenosoma hystrix, magnified $1\frac{1}{1}$.

Diadema setosum, *f. 6 – 12.*

6. Young in profile, showing anal tube, 2.4$^{mm.}$ in diam.

6^{a}. Pointed tentacles of adult Diadema, in abactinal part of poriferous zone.

Dorocidaris papillata, *f. 7 – 12.*

7. Young, partly denuded, from abactinal side, 2.4$^{mm.}$ in diam.
8. Abactinal system of same, showing mode of growth of coronal plates.
9. Plates of buccal membrane, showing continuation of the poriferous zone, of same.
10. Magnified spine of buccal membrane of same, showing mode of articulation.
11. Buccal membrane, nat. size, of larger specimen.
12. Edge of two buccal plates of large specimen, with spines and pores magnified.

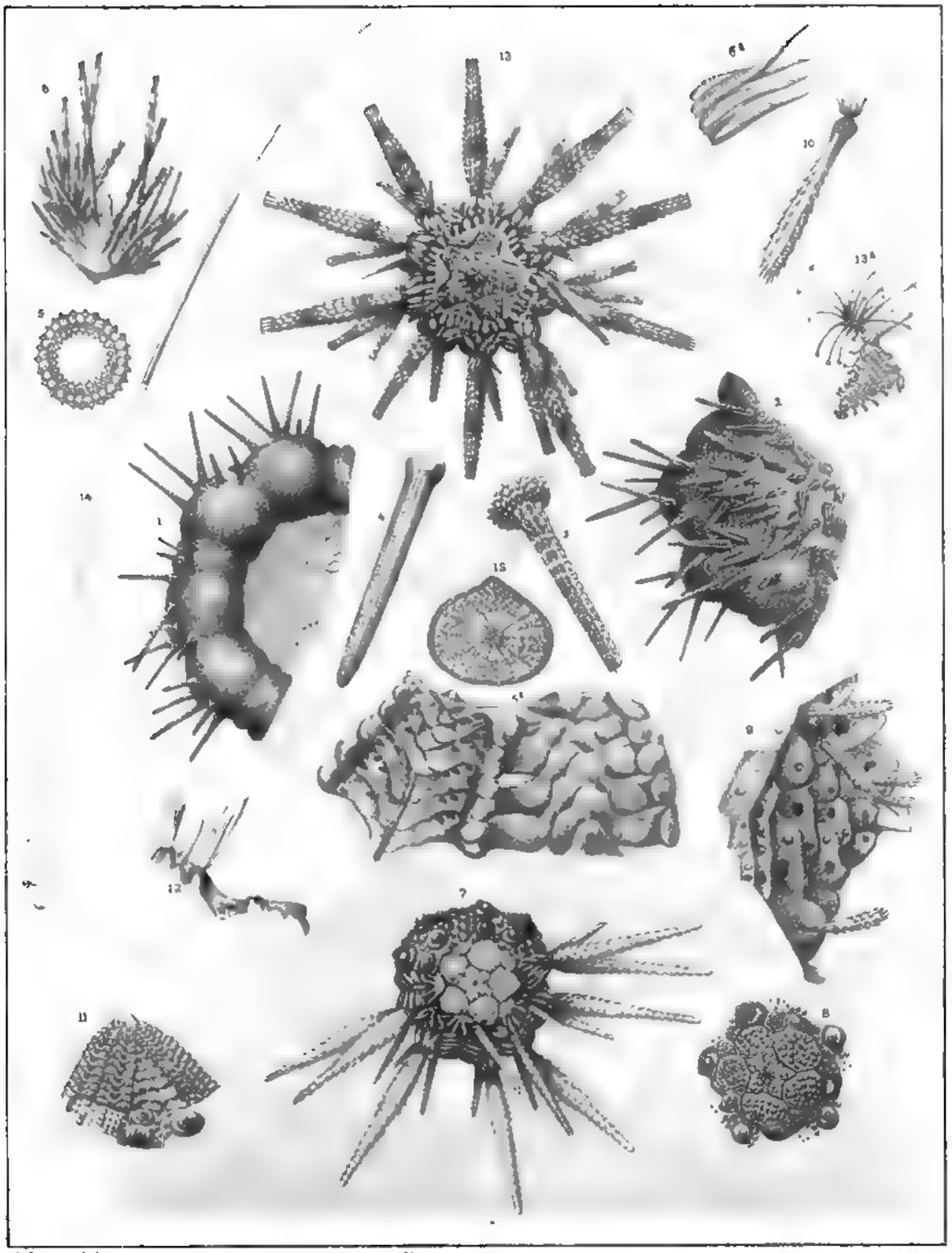
Cidaris tribuloides, *f. 13, 13^{a}.*

13. Young specimen, from abactinal side, 5.4$^{mm.}$ in diam.

13^{a}. Actinal membrane of adult, showing continuation of poriferous zone and tentacles from the edge of test to the teeth.

Coelopleurus floridanus, *f. 14, 15.*

14. Restored spine of Coelopleurus, nat. size.
15. Transverse section of same, magnified.



P Roetter, lith.g Alex.Agassiz, del. Print.by H.W.Longfellow

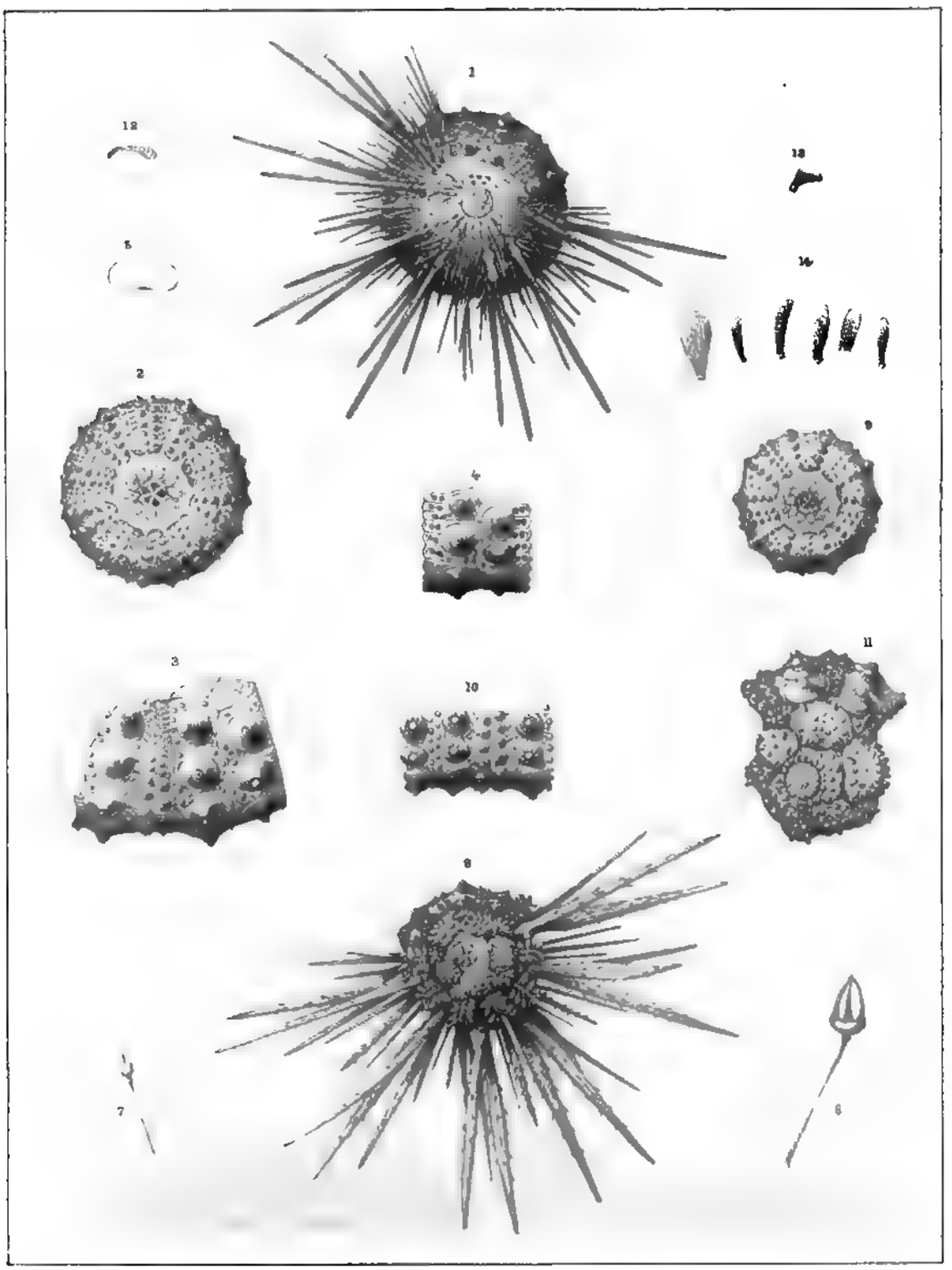
PLATE III.

Hemipedina cubensis, *f. 1–7.*

1. Specimen, measuring 12.7$^{mm.}$ in diameter from above.
2. Same from below, denuded.
3. Portion of test of same specimen.
4. Portion of ambulacral area, showing arrangement of pores.
5. Profile outline of test, nat. size.
6. Large pedicellaria, from test.
7. Young of same.

Salenia varispina, *f. 8–14.*

8. From above, $\frac{3}{4}$ nat. size.
9. From below, test denuded, same specimen.
10. Portion of ambulacral and interambulacral part of the test, magnified.
11. Abactinal system and part of test, magnified.
12. Flat spine of medium interambulacral area.
13. One of the spines of the abactinal system.
14. Different small flat spines occupying the median ambulacral areas.



P Roetter lithog. Alex Agassiz del. Print by H.W Longfellow

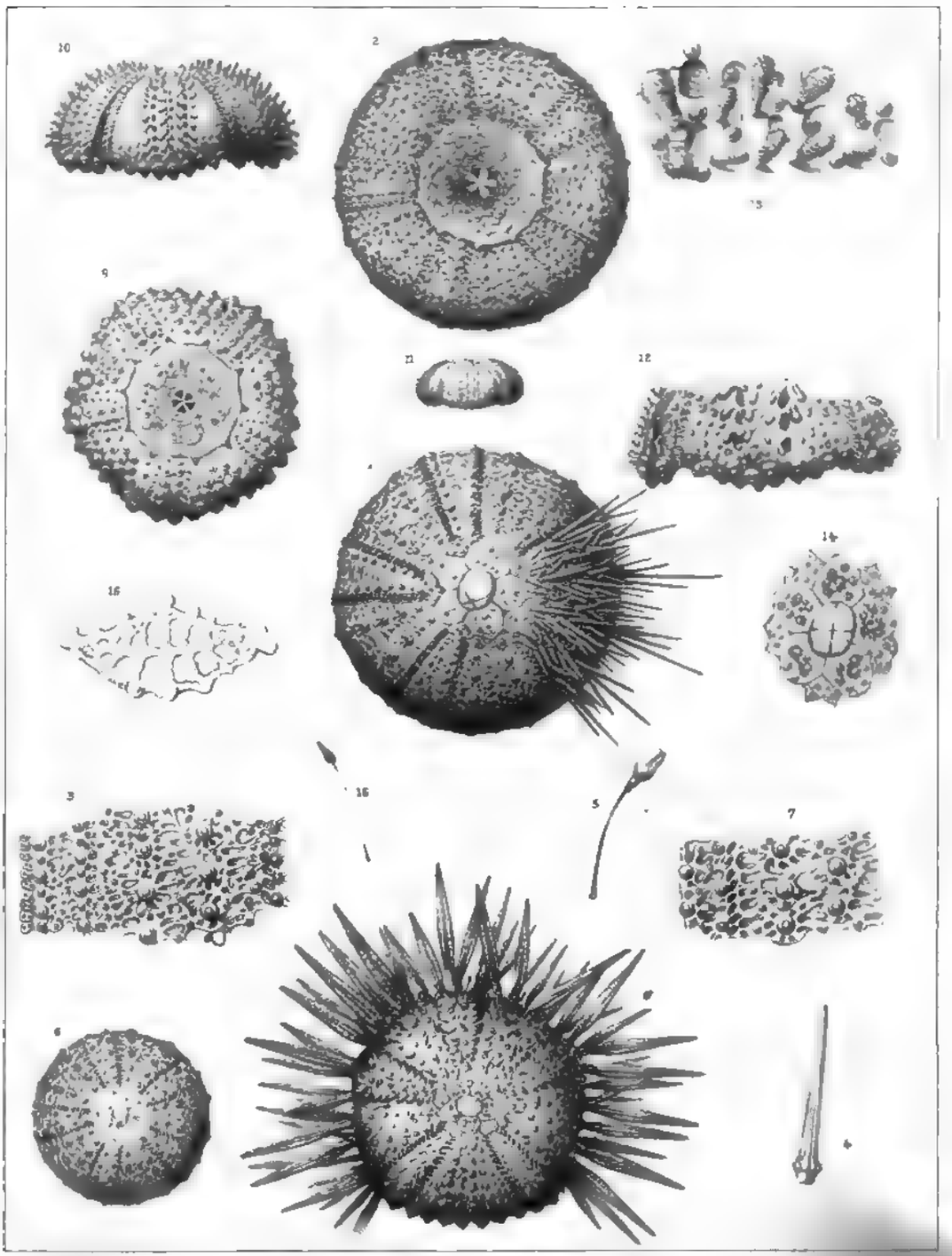
PLATE IV.

Trigonocidaris albida, *f. 1–7.*

1. Specimen measuring 12.7$^{mm.}$ in diam. from above.
2. Same measuring 12.7$^{mm.}$ in diam. from actinal side.
3. Part of test of same specimen, more highly magnified.
4. Spine of same specimen.
5. One of the pedicellariæ of test.
6. Younger specimen, measuring 4.75$^{mm.}$ in diam. from above.
7. Portion of test of same specimen.

Podocidaris sculpta, *f. 8–15.*

8. Specimen measuring 11$^{mm.}$ in diam. from above.
9. Another specimen of about same size from actinal side.
10. The same in profile.
11. Profile of a very large specimen, nat. size.
12. Portion of test of same magnified.
13. Portion of median interambulacral area of same, showing the tubercles, scrobicular circles of pedicellariæ.
14. Abactinal system of same.
15. Section of a principal spine near edge of test, greatly magnified.
16. One of the pedicellariæ.



P Poutier lithog Alex Agassiz del Print by H.W. [illegible]

PLATE IV[a].

Diadema setosum, *f. 1.*

1. Seen in profile.

Strongylocentrotus Dröbachiensis, *f. 2, 3, 6.*

2. Seen from abactinal pole.
3. Same, seen in profile.
6. Seen from actinal side; nat. size.

Toxopneustes variegatus, *f. 4, 5.*

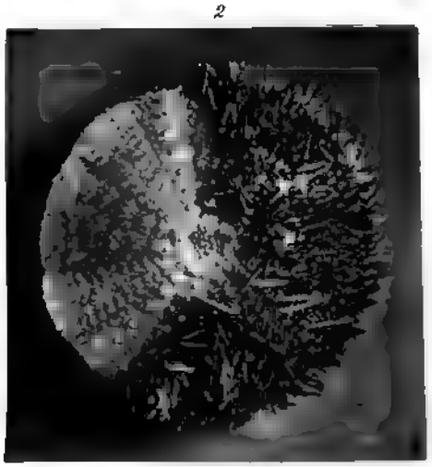
4. Seen from abactinal pole.
5. Seen from actinal side.

(*All figs.* $\frac{3}{4}$ *natural size, except fig.* 6.)

3

5

2



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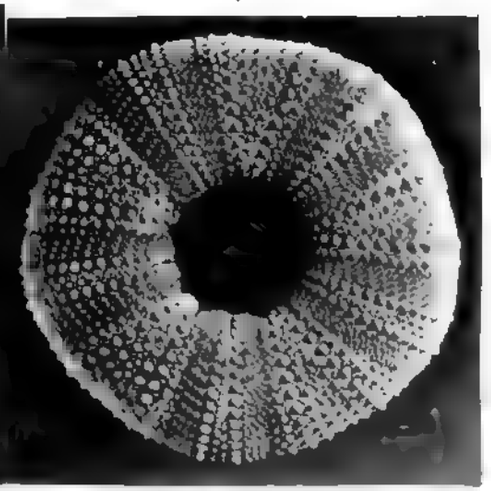

A. SONREL, Photo. American Photo-Relief Co., Printers, Phila.

PLATE V.

Arbacia punctulata, *f. 1–18.*

1. Seen in profile, somewhat reduced, with the tentacles fully expanded.
2. Same, seen from above (part of test).
3. (Somewhat magnified) profile view of the abactinal part of the test, showing the pointed tentacles.
4. A single disk bearing tentacle, one of the ten near the actinostome.
5. Cluster of gills.

6, 7. Pointed tentacles, from the flat side.

8. Pointed tentacle, from the narrow side.
9. Young, measuring 2.11$^{mm.}$ in diameter, from above.
10. Abactinal system and part of test of specimen of nearly the same size as in fig. 9.
11. The same portion of test of a specimen very slightly older.
12. Spine of fig. 9, magnified.
13. Spine of specimen of the size of fig. 14.
14. Young specimen, measuring 4.2$^{mm.}$ in diam. from above.
15. Actinal view of same.
16. Young, measuring 7.5$^{mm.}$ in diam., first appearance of pedicellariæ.
17. Spine of specimen of size of fig. 16.
18. Young, measuring 10.5$^{mm.}$ in diam., having all features of adult.

Arbacia pustulosa, *f. 19–21.*

19. Young, measuring 4.0$^{mm.}$ in diam. from above.
20. Young, measuring 3.1$^{mm.}$ in diam. from above.
21. Young, measuring 7.2$^{mm.}$ in diam. from above.

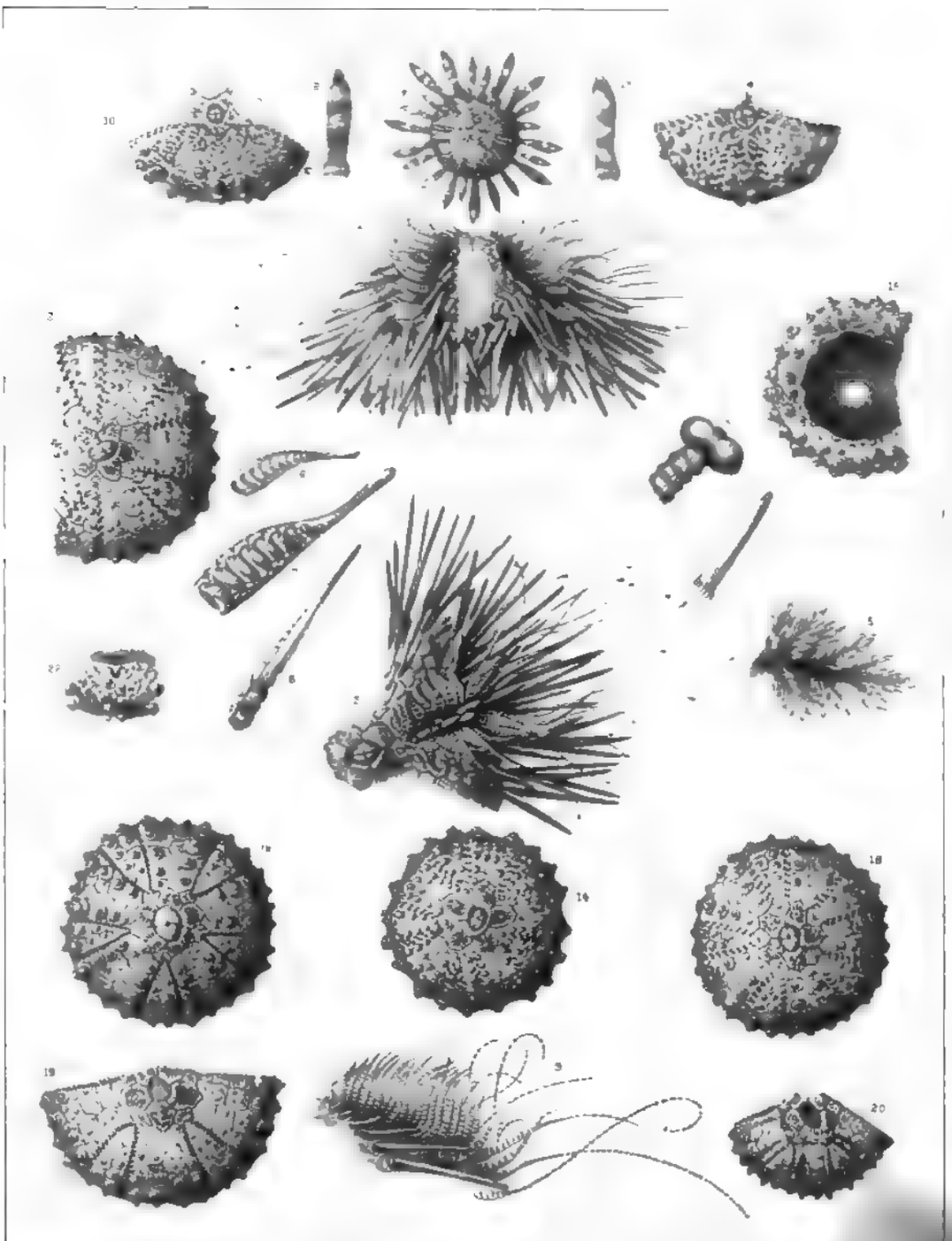

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PLATE VI.

DIAGRAM OF THE PORIFEROUS ZONE OF THE PRINCIPAL GENERA OF DESMOSTICHA.

1. **Mespilia globulus.**
2. **Phymosoma crenulare.**
3. **Phymosoma crenulare** (abactinal extremity).
4. **Echinus microtuberculatus.**
5. **Temnopleurus toreumaticus.**
6. **Salmacis sulcata.**
7. **Strongylocentrotus purpuratus.**
8. **Strongylocentrotus depressus.**
9. **Strongylocentrotus Dröbachiensis.**
10. **Strongylocentrotus franciscanus.**

10a. **Strongylocentrotus franciscanus** (juv.).

11. **Stomopneustes variolaris.**

11a. **Stomopneustes variolaris** (juv.).

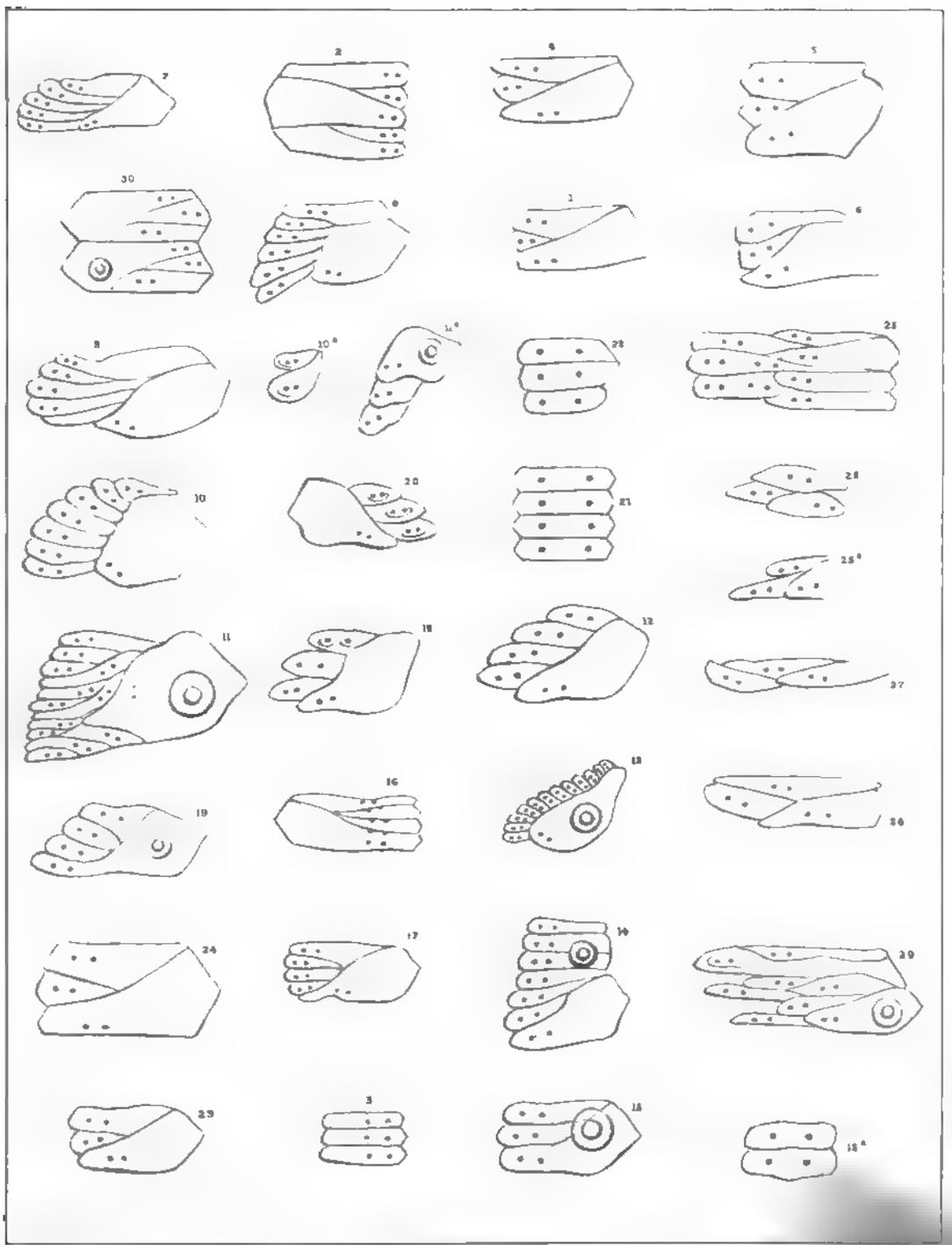
12. **Echinometra lucunter.**
13. **Heterocentrotus trigonarius.**
14. **Parasalenia gratiosa.**
15. **Diadema setosum.**

16, 17. **Sphaerechinus granularis.**

18. **Sphaerechinus Australiae.**
19. **Sphaerechinus pulcherrimus.**
20. **Echinostrephus molare.**
21. **Cidaris tribuloides.**
22. **Arbacia punctulata.**
23. **Toxopneustes variegatus.**

25a. **Holopneustes purpurascens** (juv.).

25. **Holopneustes purpurascens.**
26. **Amblypneustes.**
27. **Amblypneustes.**
28. **Hipponoë esculenta** (juv.).
29. **Hipponoë esculenta.**
30. **Evechinus chloroticus.**



P Roetzer, lithog. A Agassiz, del. Print by [illegible]

PLATE VI[a].

Hipponoë esculenta, *f. 1 - 3.*

1. Seen from actinal side, ⅔ nat. size.
2. Same seen from abactinal pole.
3. Young, from abactinal pole, nat. size.

Echinus norvegicus, *f. 4.*

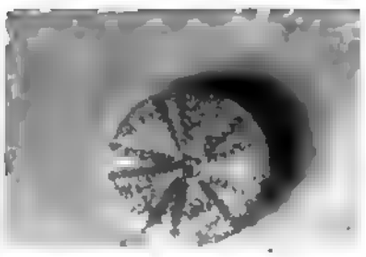
4. Seen from abactinal pole, nat. size (from Cape Wrath).

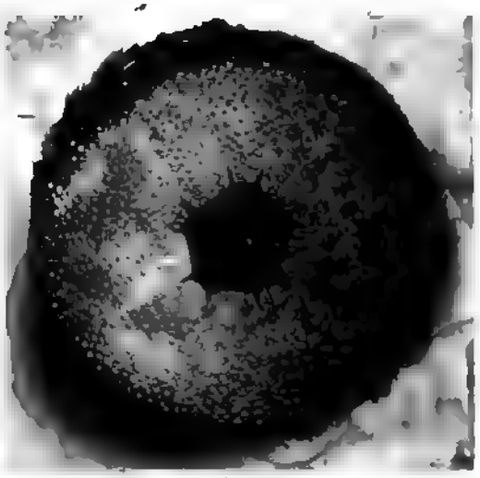
Diadema setosum, *f. 5.*

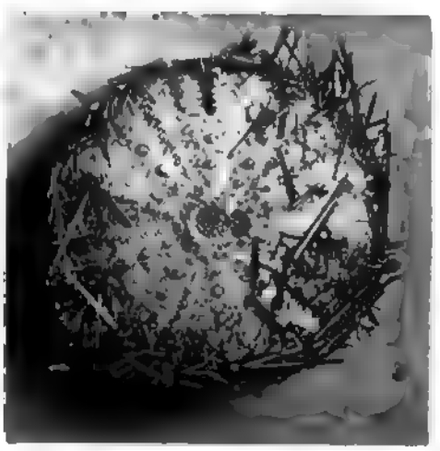
5. Seen from abactinal pole, ⅔ nat. size.

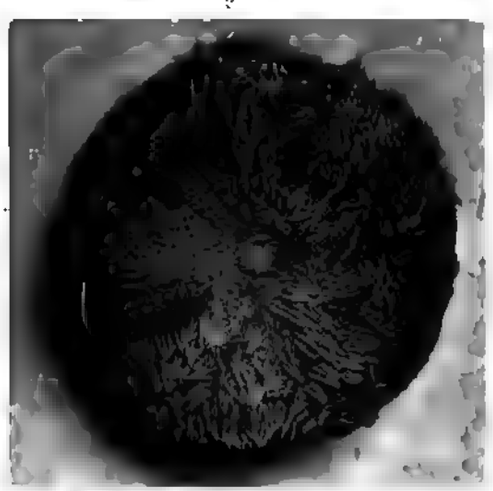
Echinus gracilis, *f.* 6.

6. Seen in profile, ⅔ nat. size.









A. Sonrel, Photo. American Photo-Relief Co., Printers, Phila.

PLATE VII.

Echinus gracilis, *f. 1–6ª*.

1. Abactinal system of specimen, measuring 10.5$^{mm.}$ in diam., magnified.
2. Part of test of same specimen magnified, showing arrangement of pores, and formation of secondary and miliary tubercles.
3. Abactinal system of specimen, measuring 43$^{mm.}$ in diam., magnified.
4. Part of test of same, magnified.
5. Abactinal system of specimen measuring 12.7$^{mm.}$ in diam., magnified.
6. Abactinal system of specimen somewhat larger ($\frac{2}{1}$).

6ª. Abactinal system of large specimen $\frac{3}{4}$.

Toxopneustes variegatus, *f. 7–22*.

7. Specimen measuring 4.74$^{mm.}$ in diam. from actinal pole, magnified.
8. Magnified part of test of same specimen as fig. 7.
9. Same (fig. 7) seen from abactinal side.
10. Specimen measuring 6.2$^{mm.}$ in diam. from abactinal pole, magnified.
11. Magnified part of test of same (fig. 10).
12. Spine of same, magnified.
13. Actinal side of same, magnified.
14. Specimen measuring 10.9$^{mm.}$ from actinal pole, magnified.
15. Magnified part of test of same (fig. 14).
16. Same specimen (fig. 14) from abactinal side.
17. Abactinal system of specimen, from Florida ($\frac{3}{1}$).
18. Abactinal system of specimen somewhat older ($\frac{4}{1}$).
19. Abactinal system of larger specimen ($\frac{2}{1}$).
20. Buccal membrane of same ($\frac{2}{1}$).
21. Portion of test of specimen, measuring 38$^{mm.}$ in diam.
22. Portion of test of specimen, measuring 57$^{mm.}$ in diam.

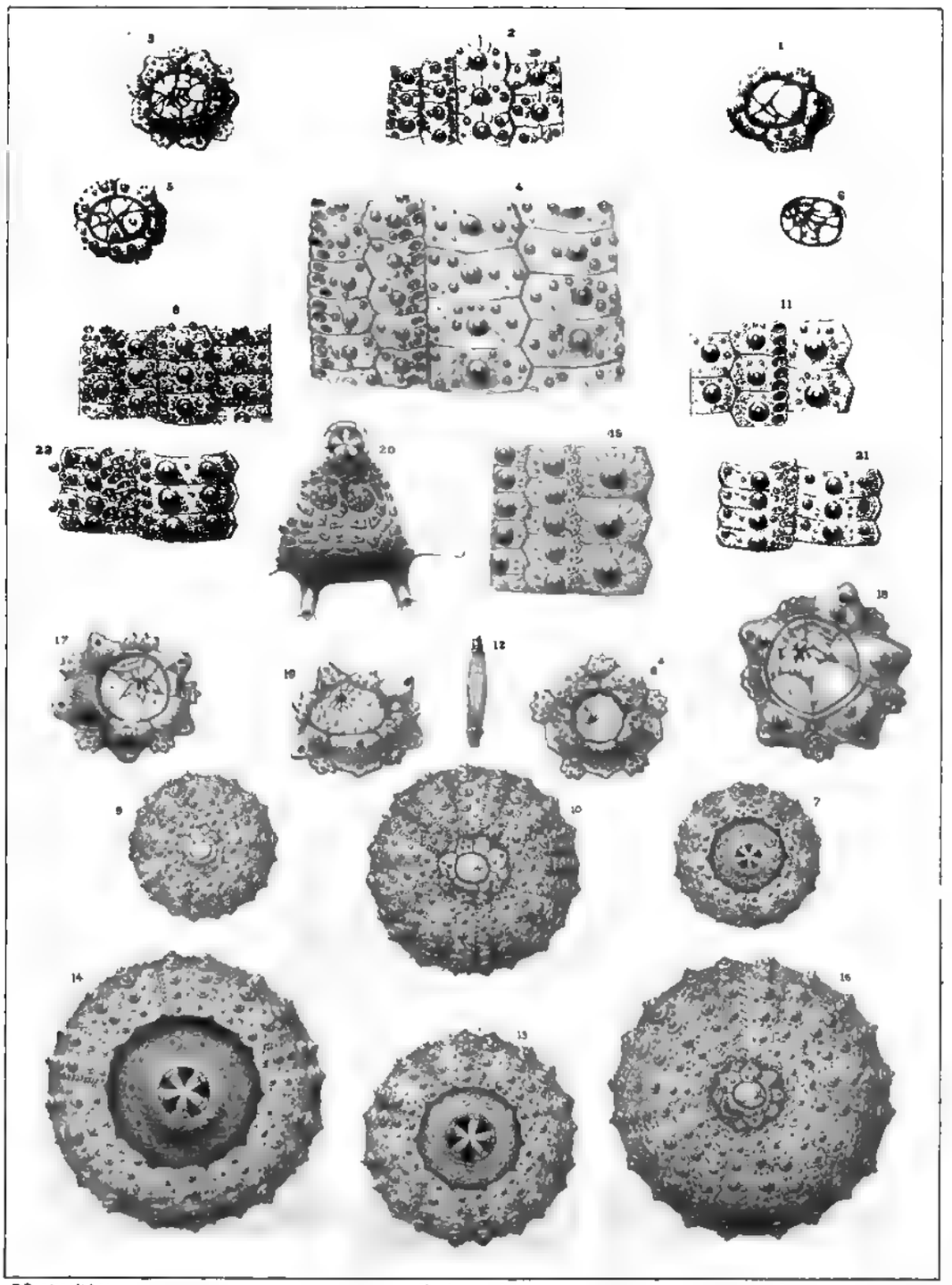


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PLATE VIII.

Temnechinus maculatus, *f. 1 - 18.*

1. Specimen from abactinal pole, one half denuded, 12.7^{mm}. in diam.
2. Same, without spines, showing actinal cuts.
3. Abactinal system of same specimen, showing the large anal plate.
4. Magnified portion of test of same specimen.
5. Spine of same, magnified.
6. Pedicellaria of same, magnified.
7. Outline of specimen in profile.
8. Specimen somewhat younger, from above, measuring 7.2^{mm}.
9. Same from actinal side.
10. Abactinal system of same specimen, magnified.
11. Magnified portion of test of same.
12. Magnified spine of same.
13. Auricle of same specimen.
14. Magnified portion of test of fig. 15.
15. Young specimen from actinal side, measuring 2.5^{mm}. in diam.
16. Young specimen, pentagonal, flat, with Cidaris-like spines, seen from abactinal side, measuring 0.8^{mm}. in diam.
17. Test of same denuded from actinal side.
18. Spine of specimen somewhat older.

Echinus microtuberculatus, *f. 19 - 21.*

19. Young specimen, measuring 5.1^{mm}. in diam., showing size of actinostome.
20. Magnified part of test of same.
21. Magnified part of test of younger specimen (2.1^{mm}. in diam.).

Temnopleurus Reynaudi, *f. 22 - 25.*

22. Part of test of specimen measuring 18.6^{mm}. in diam.
23. Anal system of specimen measuring 7.9^{mm}. in diam.
24. Part of test of specimen of fig. 23.
24'. Abactinal system of specimen of fig. 22.

Temnopleurus Hardwickii, *f. 26.*

25. Part of test of specimen measuring 7.9^{mm}. in diam.
26. Part of test of specimen measuring 11^{mm}. in diam.
27. Abactinal system of same (11^{mm}. in diam.).
28. Abactinal system of specimen measuring 7.9^{mm}. in diam.

Hipponoë esculenta, *f. 29.*

29. Arrangement of part of poriferous zone of young specimen.

Temnechinus globosus, *f. 30.*

30. Part of test of specimen measuring 18^{mm}. in diam. from the Crag.

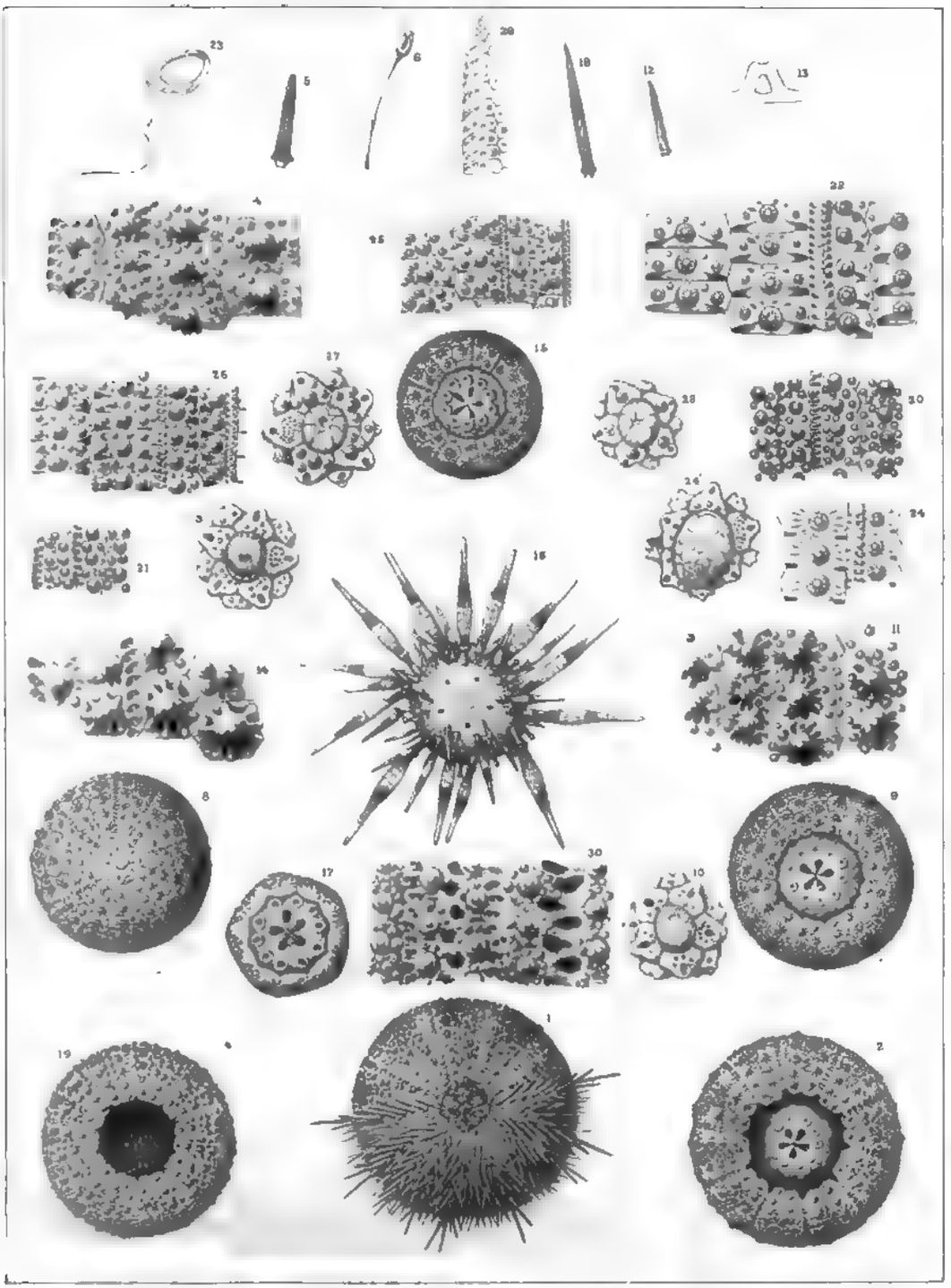

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PLATE IX.

Strongylocentrotus Dröbachiensis.

1. Young specimen immediately after resorption of Pluteus, greatly magnified, abactinal side.
2. Specimen somewhat older, denuded (actinal side).
3. Abactinal view of young, having from 5 to 6 plates, magnified $\frac{4}{1}$.
4. Same from actinal side.
5. Same, magnified portion of ambulacral and interambulacral space.
6. Abactinal system of young, measuring 3.6$^{mm.}$ in diam.
7. Same specimen from the actinal side.
8. Abactinal view of specimen measuring 5.4$^{mm.}$ in diam.
9. Magnified portion of test of same specimen.
10. Actinal view of same.
11. Abactinal view of specimen measuring 8.2$^{mm.}$ in diam.
12. The same seen from actinal side.

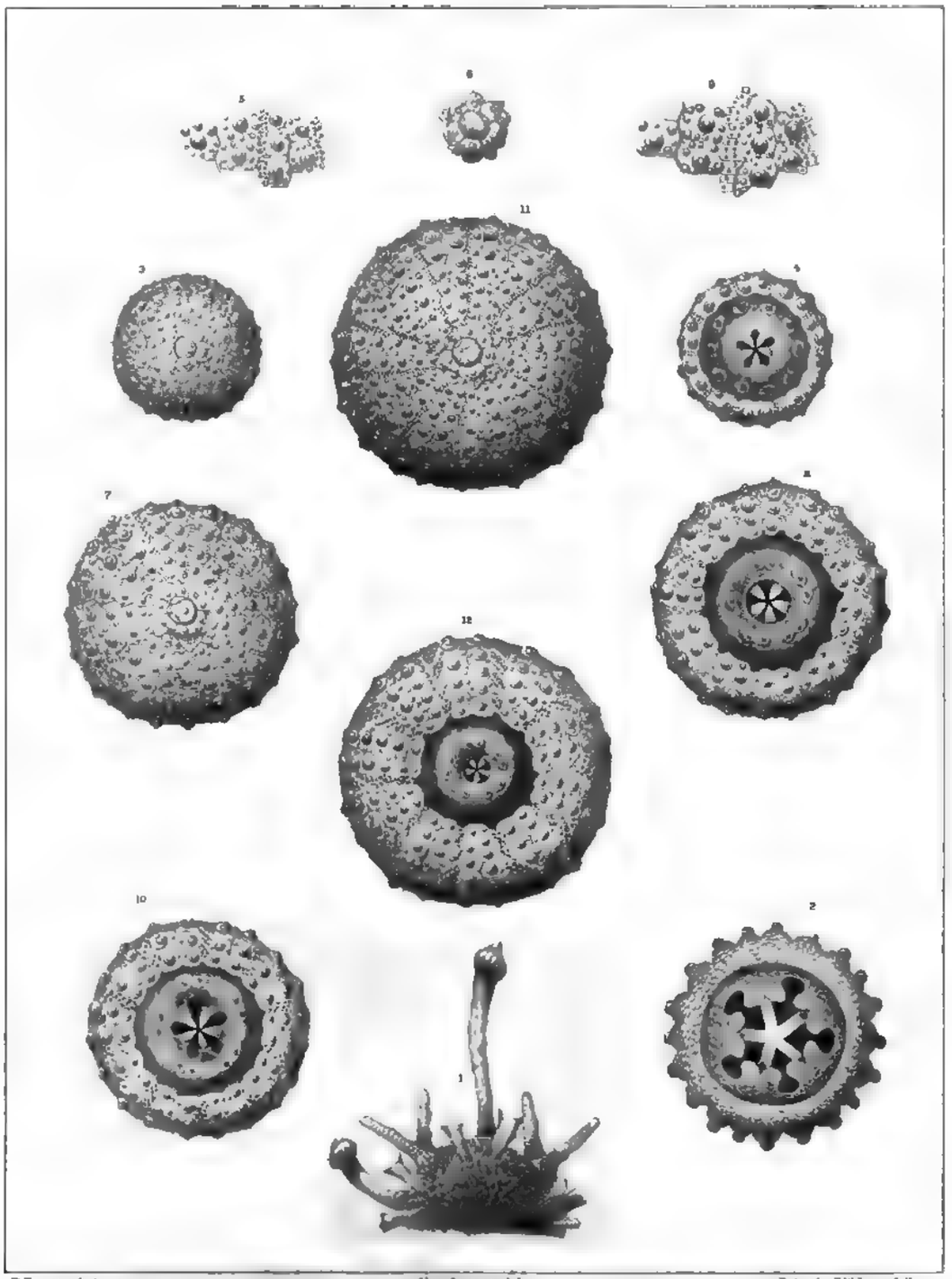

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PLATE X.

Strongylocentrotus Dröbachiensis.

1. Specimen, nat. size, with tentacles fully expanded from abactinal side.
2. 1.6$^{mm.}$ in diam. including spines, where spines have assumed the shape of adult, with pedicellaria and anal plate.
3. Specimen somewhat younger, having only five tentacles, from actinal side.
4. The same seen from abactinal side.

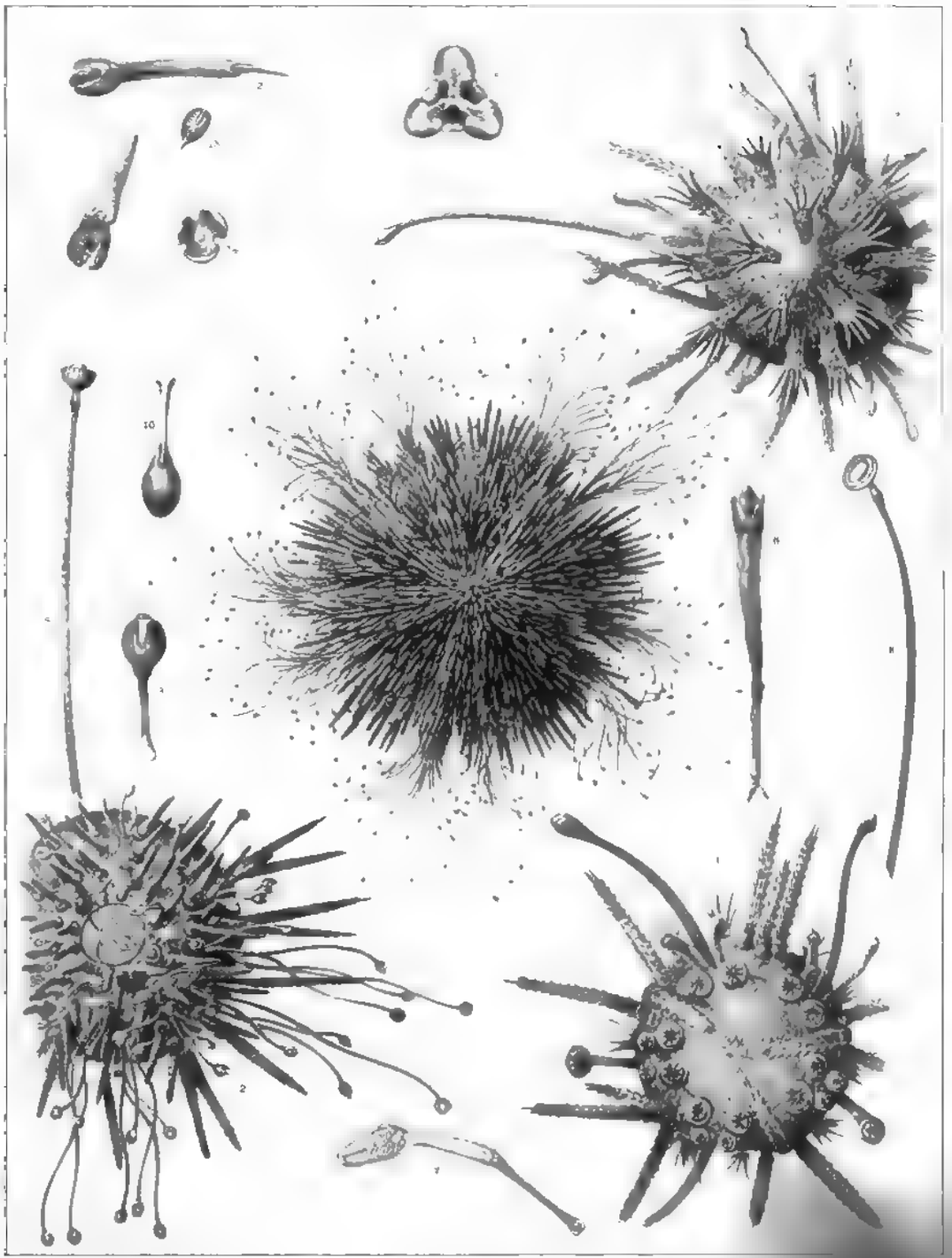
5, 6. Expanded tentacles of adult, magnified.

7, 8. Pedicellariæ of the abactinal part of test.

9, 10. Pedicellariæ round the actinostome.

11 – 13. Pedicellariæ of abactinal part of test in different stages of growth.

14, 15. Pedicellariæ of abactinal part of test, seen from above.



F. Huetter Lith. Alex Agassiz del.

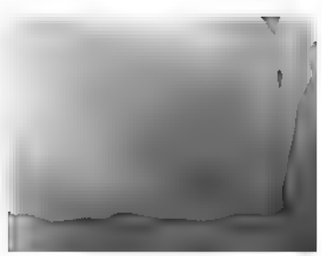
PLATE X*.

Echinometra viridis, *f. 1.*

1. Seen from abactinal pole, nat. size.

Echinometra subangularis, *f. 2–4.*

2. Seen from abactinal pole, nat. size.
3. Other specimen, nat. size, with more slender spines.
4. Same from actinal side.



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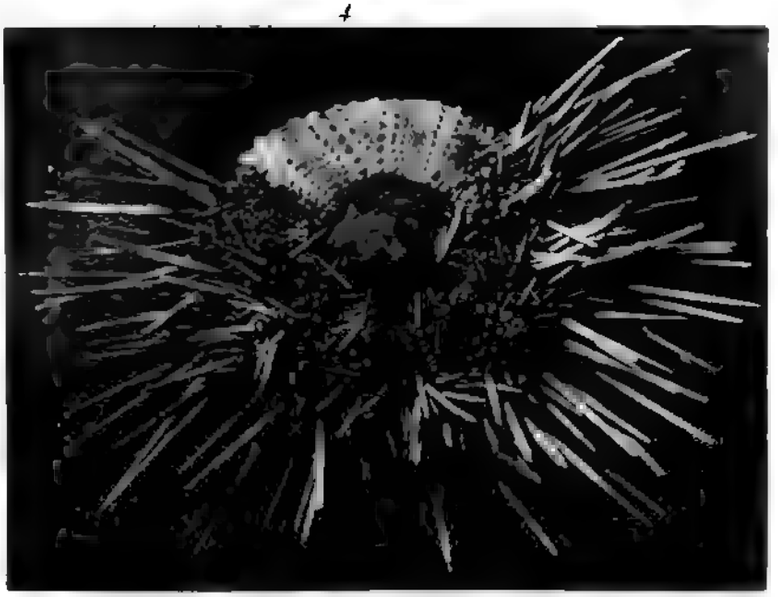

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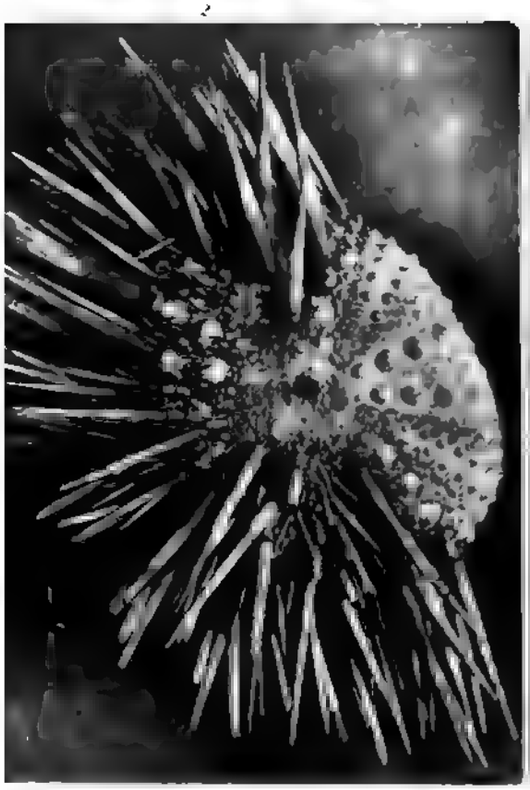

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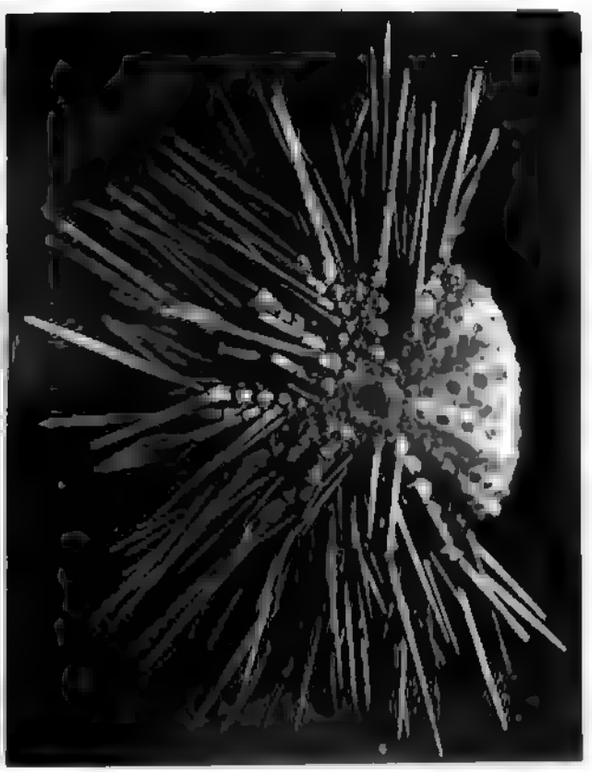

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PLATE XI.

Mellita sexforis, *f. 1–12.*

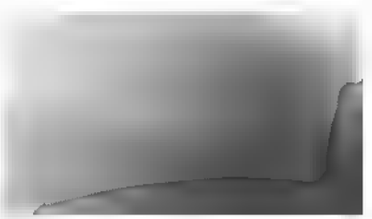
1. Young M. sexforis of a Laganum shape, no posterior interambulacral lunule seen from above, 2.4$^{mm.}$ in diam.
2. Same from actinal side, deeply concave, showing commencement of lunule.
3. Young, showing first trace of posterior interambulacral lunule, from above, 4.0$^{mm.}$ in diam.
4. Same from actinal side.
5. Rotulæ of same magnified.
6. Posterior interambulacral lunule of specimen measuring 5.3$^{mm.}$ in diam., magnified.
7. Young specimen, measuring 7 5$^{mm.}$ in diam., from above.
8. Same from actinal side, no trace as yet of pits forming ambulacral lunules.
9. Young specimen, measuring 10.1$^{mm.}$ in diam., from above, showing trace of the ambulacral lunules all unequally developed.
10. The same from below, showing the deep pits, unequal in size, forming the rudimentary lunules.
11. Young specimen, measuring 12.7$^{mm.}$ in diam., with all the ambulacral lunules completely pierced through and well formed.
12. Young specimen, measuring 38$^{mm.}$ in diam., having all the the principal features of the adult.

Mellita testudinata, *f. 13–22.*

13. Young, with scarcely a trace of notches and a well-formed posterior lunule; from above, nat. size.
14. Posterior part of test of same from above, magnified.
15. Somewhat older specimen than fig. 13.
16. Magnified portion of test of same from above.
17. Magnified portion of test of same from below.
18. Young specimen, older than fig. 15, with a trace of notches, commencement of ambulacral lunules.
19. Young specimen, considerably older, with deep notches, nat size.
20. Rotulæ, with part of poriferous zone, of fig. 18, magnified.
21. Part of ambulacral rosette of specimen measuring 60$^{mm.}$ in diam.
22. Diagram of arrangement of pores of Mellita testudinata.
23. Diagram of arrangement of pores of Echinanthus rosaceus.

Mellita longifissa, *f. 24–27.*

24. Young, nat. size, from above; ambulacral notches commencing to close.
25. Part of test of same, magnified.
26. Young, nat. size, with ambulacral notches changed to lunules.
27. Part of test of same, magnified.



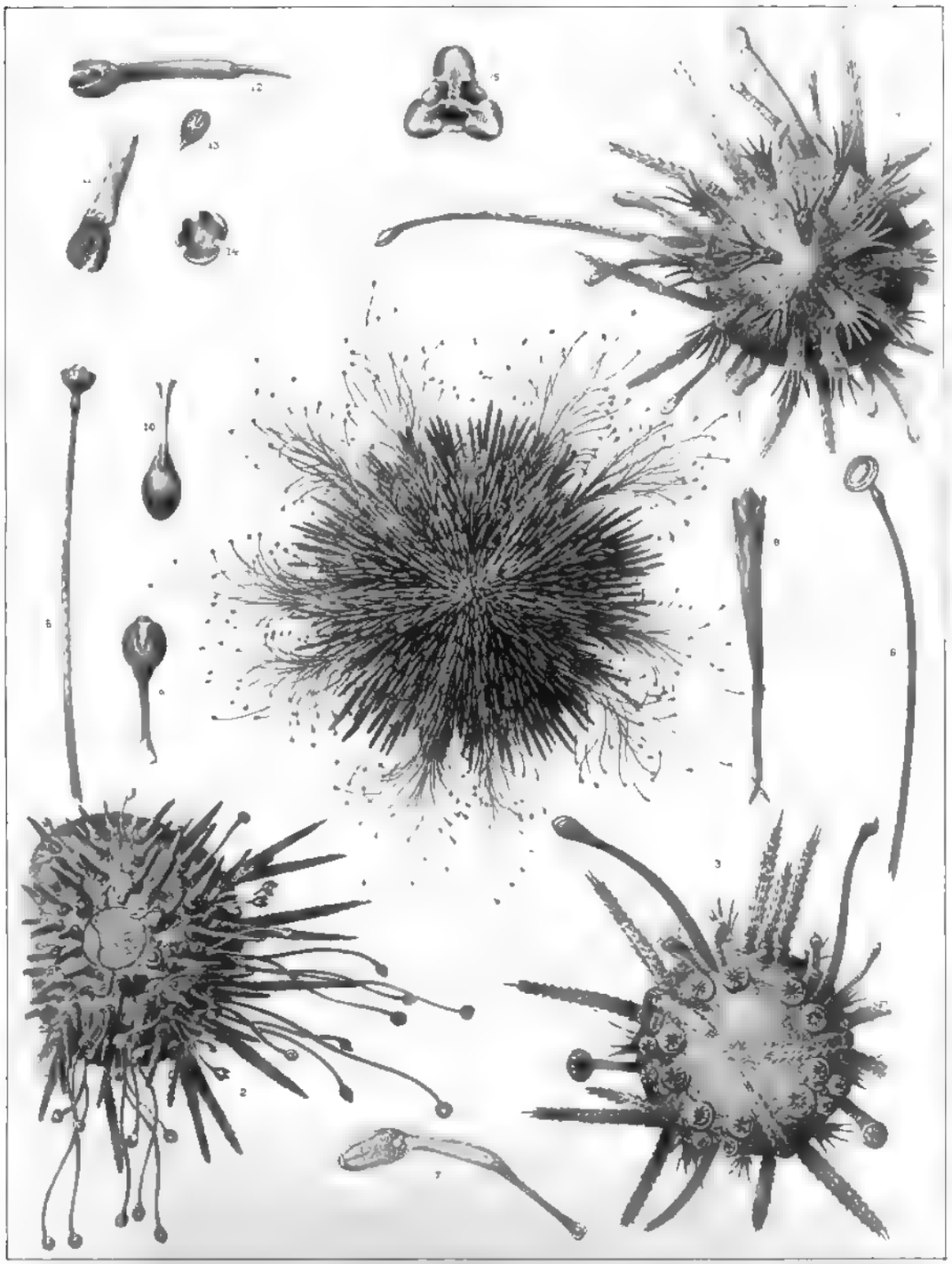


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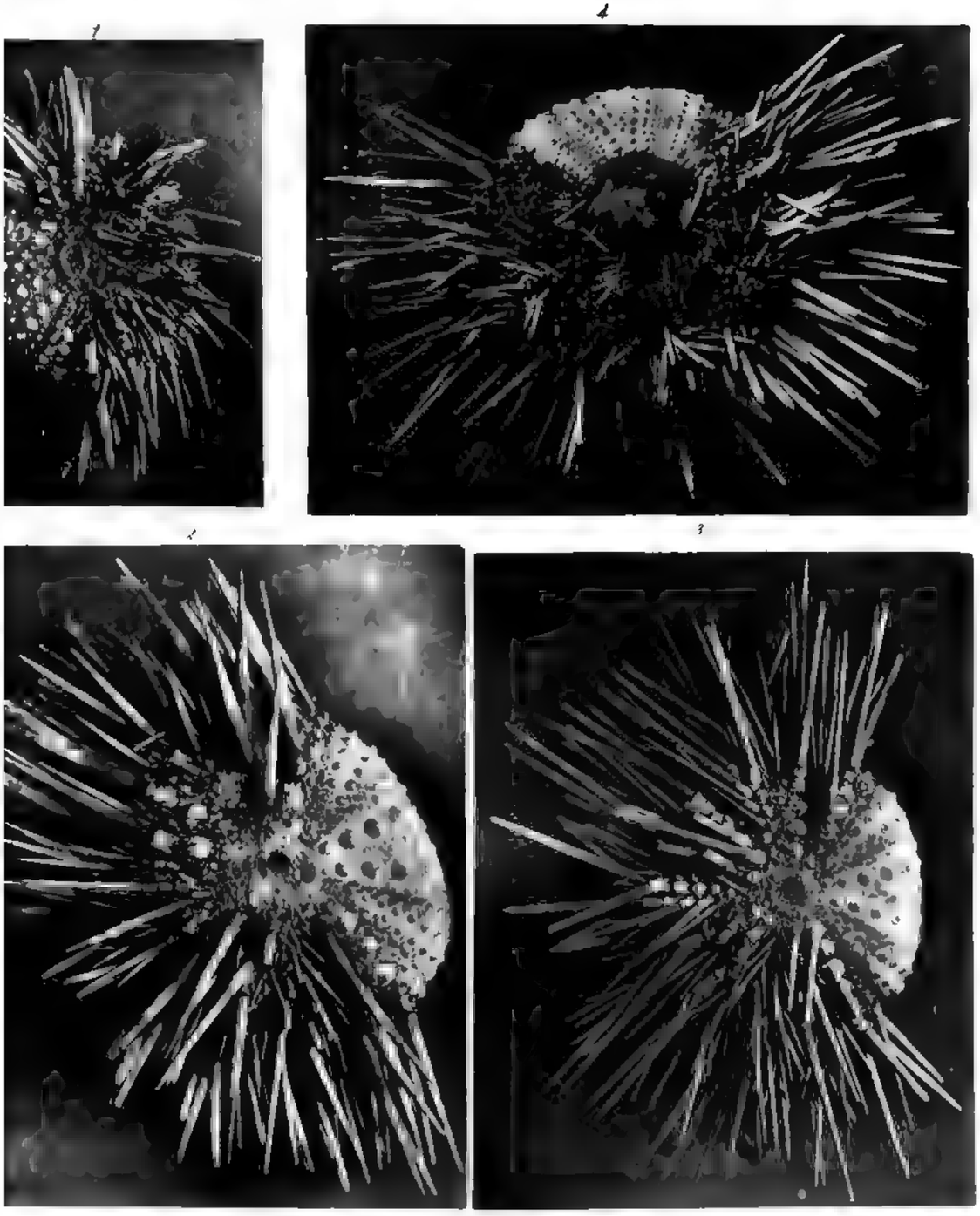
PLATE X[a].

Echinometra viridis, *f. 1.*

1. Seen from abactinal pole, nat. size.

Echinometra subangularis, *f. 2–4.*

2. Seen from abactinal pole, nat. size.
3. Other specimen, nat. size, with more slender spines.
4. Same from actinal side.



A. Sonrel, Photo

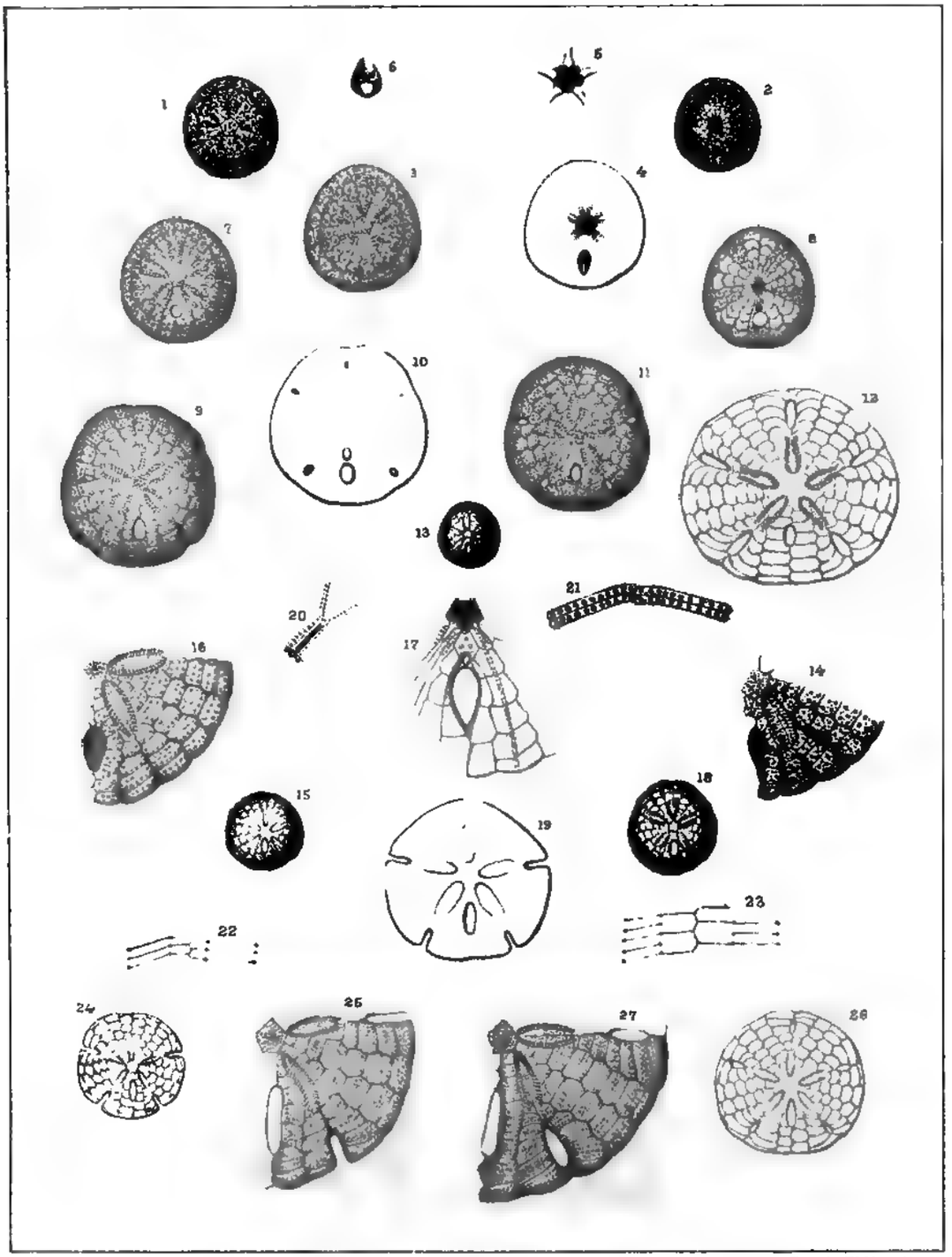
American Photo-Relief Co., Printers, Phila.

PLATE XI[b].

Clypeaster subdepressus.

1. Seen from above.
2. Seen from actinal side.
3. Actinal floor removed, showing petaloid ambulacra connecting with the main cavity.
4. Abactinal part of test removed to show needle-like pillars of the actinal floor.

(*All figs.* ⅔ *natural size.*)



P Rossiter lithog: Alex. Agassiz del. Print by H.W. Longfellow

PLATE XI[a].

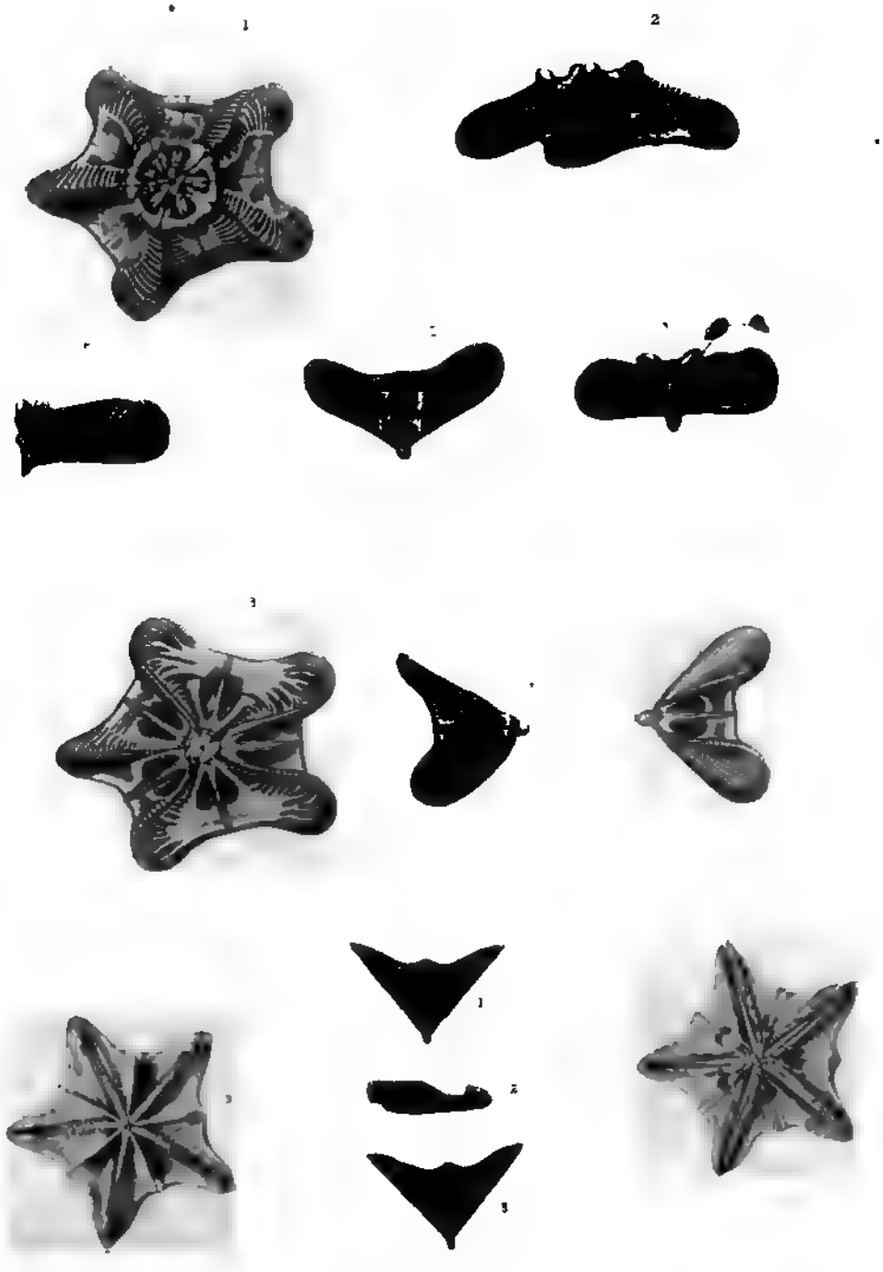
Clypeaster humilis, *f. 1–8.*

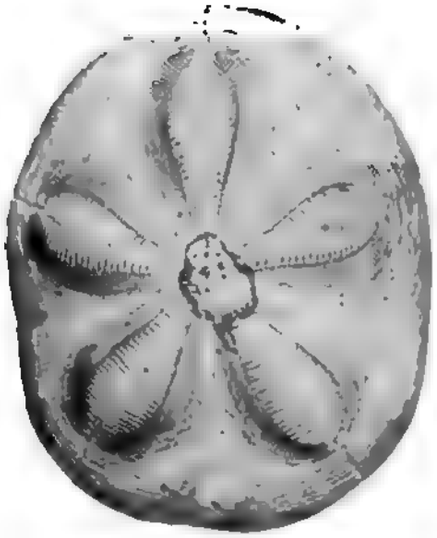
1. The five jaws seen from abactinal side.
2. Same seen in profile.
3. Same seen from the actinal side.
4. One of the jaws in profile.
5. One of the jaws seen from the centre of mouth.
6. One of the jaws seen endwise.
7. Single lateral jaw seen from the actinal side.
8. The odd jaw seen from the actinal side.

Echinodiscus auritus, *f. 9–13.*

9. The five jaws seen from the abactinal side.
10. Same seen from the actinal side.
11. Single jaw seen from the actinal side.
12. Single jaw seen in profile.
13. Single jaw seen from the abactinal side.

(*All figs. natural size.*)





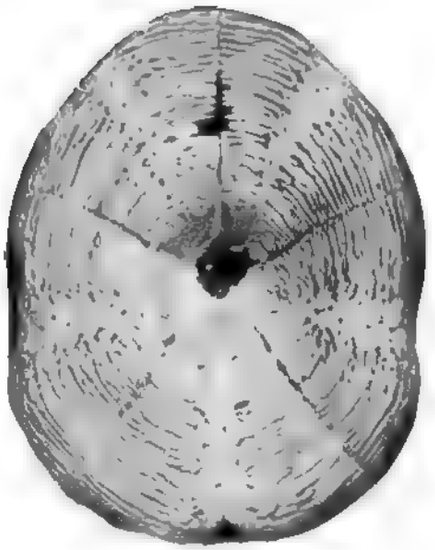


PLATE XI[c].

Clypeaster subdepressus, *f. 1, 2.*

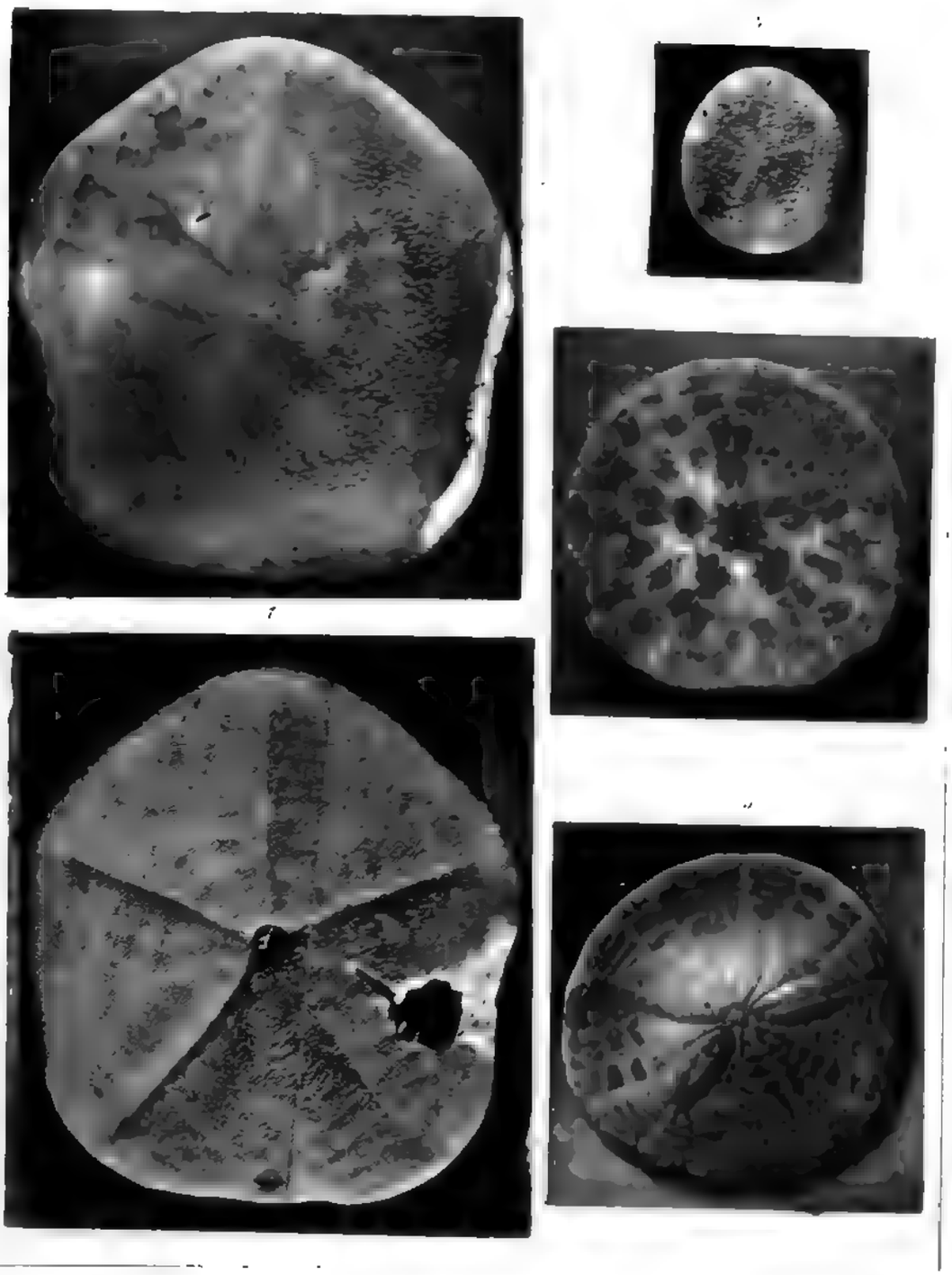
1. Seen from abactinal side, specimen with thick edge, $\frac{3}{4}$ nat. size.
2. Seen from actinal side, specimen with thick edge, $\frac{3}{4}$ nat. size.

Echinocyamus pusillus, *f. 3.*

3. Seen from above, magnified three diam.

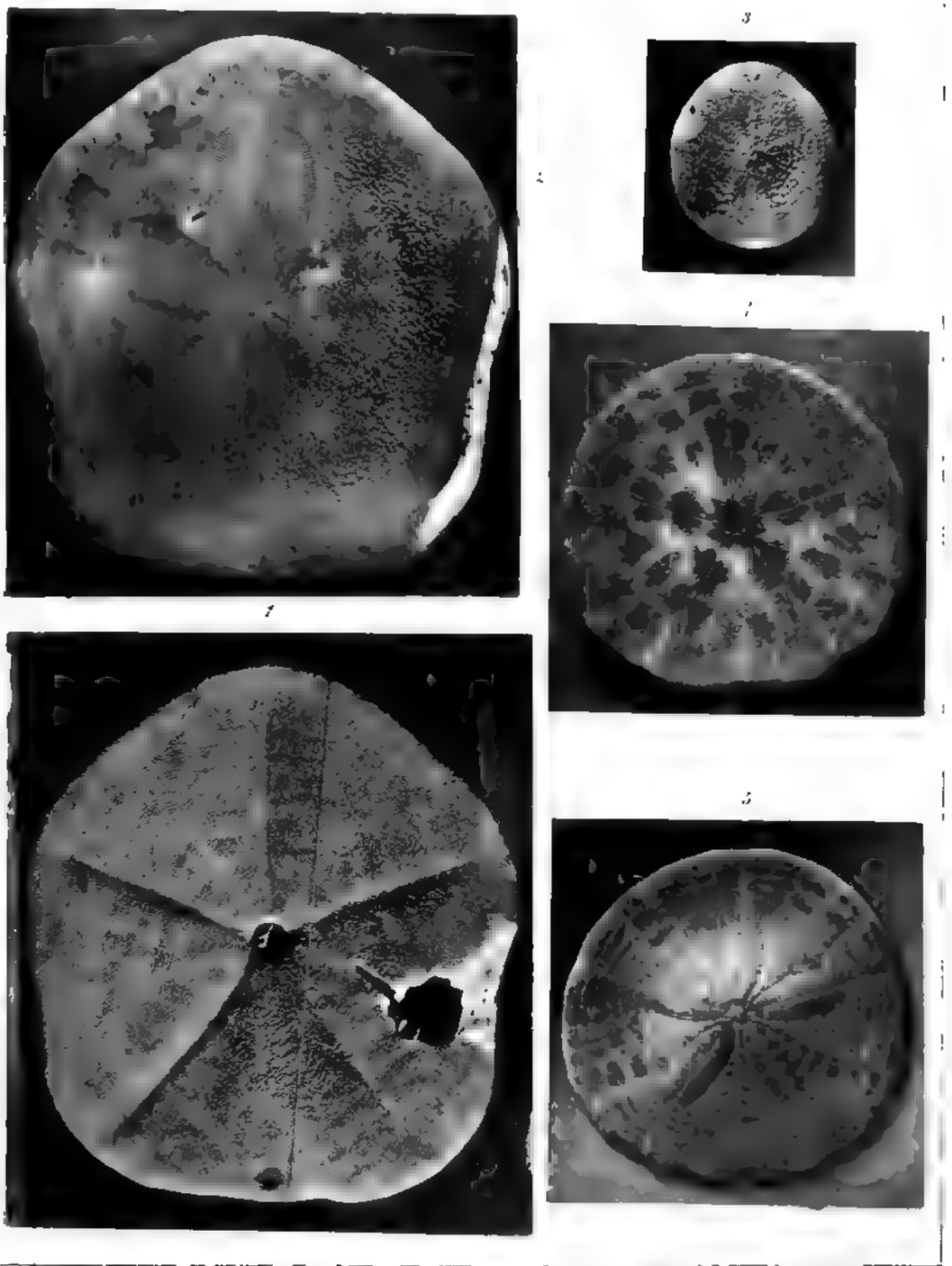
Echinarachnius parma, *f. 4, 5.*

4. From actinal side, denuded, nat. size.
5. Same from abactinal side, nat. size.



A. ROBERT, Photo.

American Photo-Relief Co., Printers, Phila.



A. SONREL, *Photo.* American Photo-Relief Co., Printers, Phila.

PLATE XV.

Echinanthus rosaceus, *f. 1–18.*

1. Young specimen, from abactinal side, with spines, nat. size.
2. Part of petaloid ambulacrum of same magnified, showing the tentacles provided with suckers.
3. Portion of edge of test of same, showing the tentacles passing through the test outside of the regular poriferous zone.
4. Part of test of same, denuded, magnified.
5. Magnified portion of petaloid ambulacrum, pores connected by furrows.
6. First kind of tridactyle pedicellaria, with shaft, magnified.
7. Same closely contracted.
8. Terminal part of jaw of pedicellaria.
9. Pedicellaria closed, seen from above, magnified.
10. Second kind of globular pedicellaria carried upon a slender shaft and long contractile stem, magnified.
11. Younger stage of same.
12. Young fan-shaped articulated spine, magnified greatly.
13. Somewhat younger spine.
14. Spine having all features of the spines of large, full-grown specimens, magnified.
15. Section of edge of a specimen, somewhat older, showing commencement of the double-chambered walls, $\frac{3}{4}$ nat. size.
16. Magnified part of interambulacral part of test of same, showing the ambulacral pores discovered by Müller.
17. Portion of petaloid ambulacrum of adult specimen, nat. size.
18. Magnified portion of same, to show the lobed tentacles of the petaloid ambulacra.

Spatangus purpureus, *f. 19–22.*

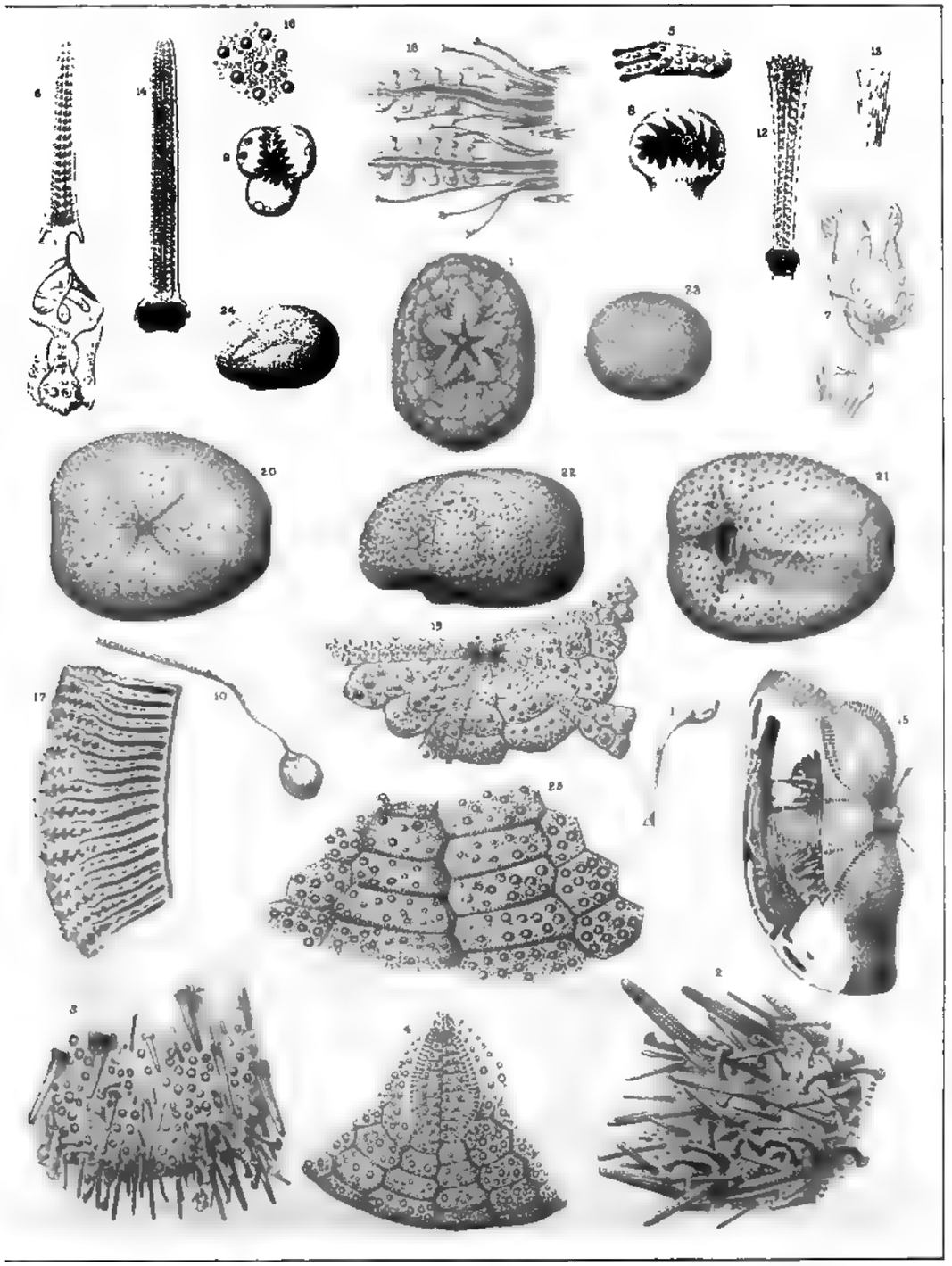
19. Magnified abactinal part of test of fig. 20.
20. Young specimen, from abactinal pole, $\frac{3}{4}$ nat. size.
21. Same from actinal side.
22. Same seen in profile.

Agassizia excentrica, *f. 23, 24.*

23. Same from abactinal pole, nat. size.
24. Seen in profile, nat. size.

Clypeaster subdepressus, *f. 25.*

25. Part of the poriferous zone of the actinal side of specimen measuring $25.4^{mm.}$ in diam., magnified.



Roetter, lithog. Alex. Agassiz, del Print.by H.W Longfellow

PLATE XII.

Echinarachnius parma, *f. 1 – 13.*

1. Young, from above, magnified $\frac{10}{1}$, elongated Echinometra-like.
2. The same from actinal side.
3. The same in profile.
4. Somewhat older than preceding, from above, $\frac{5}{1}$.
5. Older than fig. 4, from above, $\frac{7}{1}$.
6. The same as fig. 5, from below, $\frac{7}{1}$.
7. Rotula of specimen of fig. 4, magnified.
8. Rotula of specimen of fig. 6, magnified.
9. Older specimen, first trace of conjugation of pores, from above, $\frac{5}{1}$.
10. Still older than preceding, ambulacra petaloid, from above, $\frac{3}{1}\frac{3}{3}$.
11. Anal plate of anal system, fig. 9.
12'. Anal plates covering anal system, fig. 10.
12. Anal plates of specimen measuring 11.5$^{mm.}$ in diam.
13. Young Echinarachnius 15.1$^{mm.}$ in diam., having all main features of adult.

Encope emarginata, *f. 14 – 25.*

14. Young from above, in Moulinsia stage, $\frac{18}{1}$.
15. Young from below, in Moulinsia stage, $\frac{18}{1}$, showing first trace of posterior lunule.
16. Abactinal part of ambulacrum of fig. 14, somewhat more magnified.
17. Young, posterior lunule seen from above, nat. size.
18. Part of fig. 17, from actinal side, somewhat magnified.
19. Part of test of same, from above, still more magnified.
20. Young Encope, from above, slight indentations, nat. size.
21. Part of test of same, from actinal side, magnified.
22. Older than fig. 20, deeper indentations and larger lunule, nat. size.
23. Posterior lunule and anus of fig. 22.
24. Encope older than fig. 22, with deeper indentations.
25. Anus and posterior lunule of fig. 24.

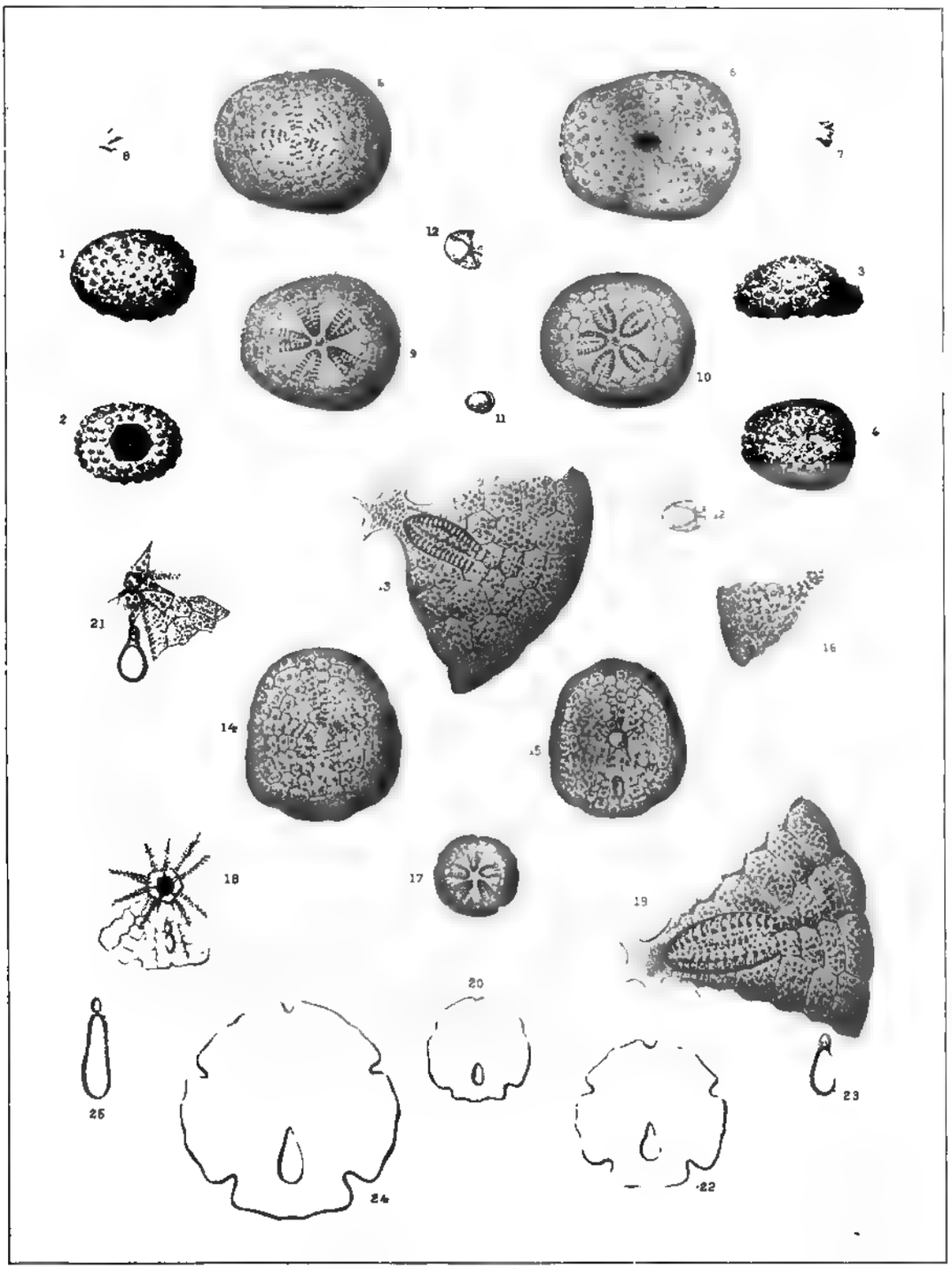


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PLATE XII[a].

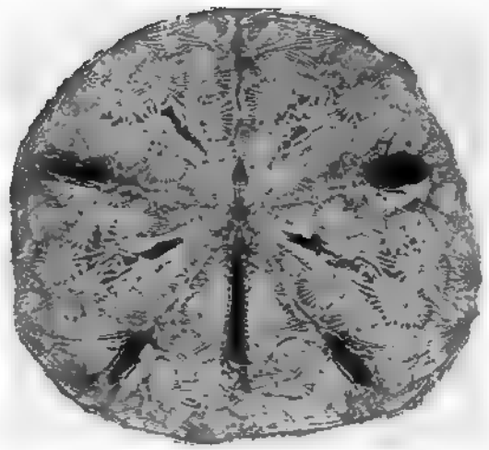
Mellita testudinata.

1. Actinal floor removed, showing interior cavity.
2. Actinal ramifications of limestone floor.
3. Abactinal ramifications of limestone floor.
4. Abactinal system removed, showing actinal interior cavity.

(*All figs. nat. size.*)

1

2



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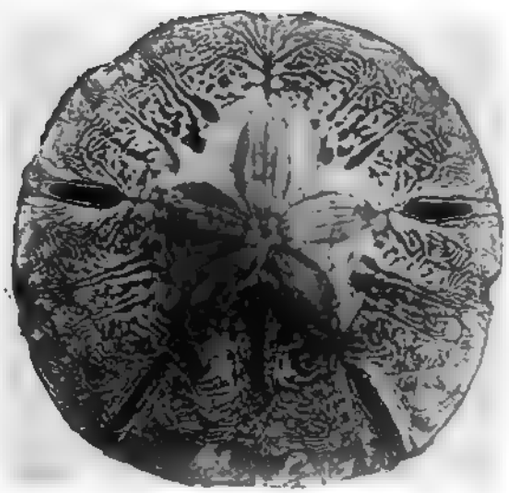

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A.Sonrel Photo. Photo Plate Print

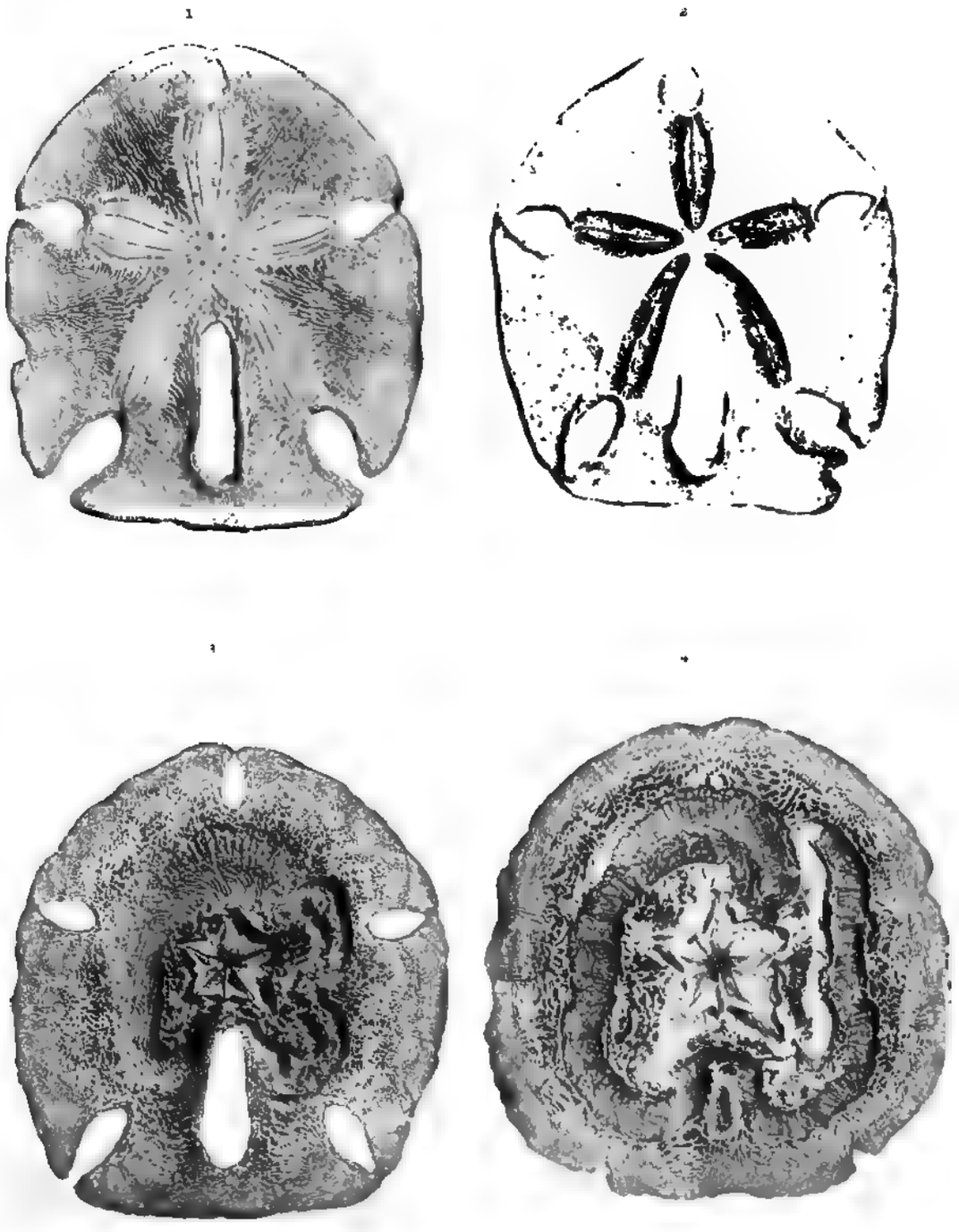


PLATE XII°.

Mellita testudinata, *f. 1, 2.*

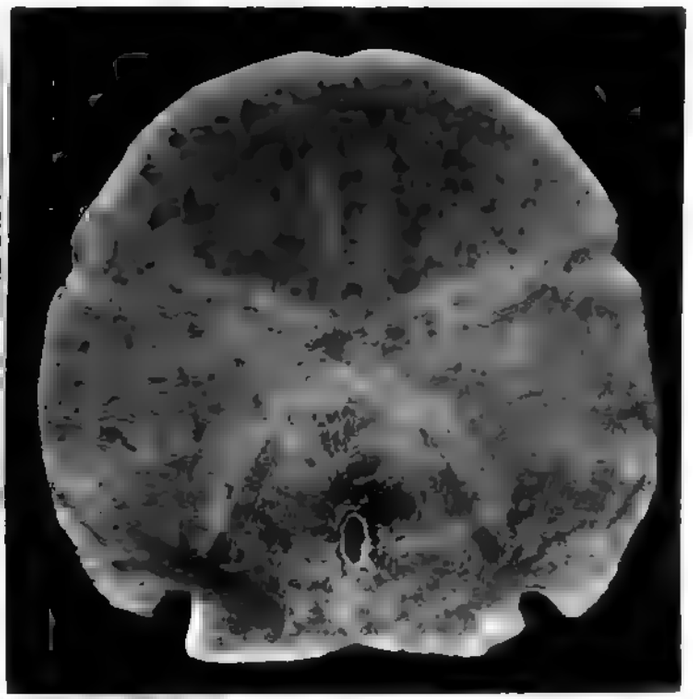
1. Seen from abactinal side, nat. size.
2. Seen from actinal side, nat. size.

Encope Michelini, *f. 3, 4.*

3. Seen from above, $\frac{2}{3}$ nat. size.
4. Seen from actinal side, to show the ramifications of the water system, $\frac{2}{3}$ nat. size.

1

3



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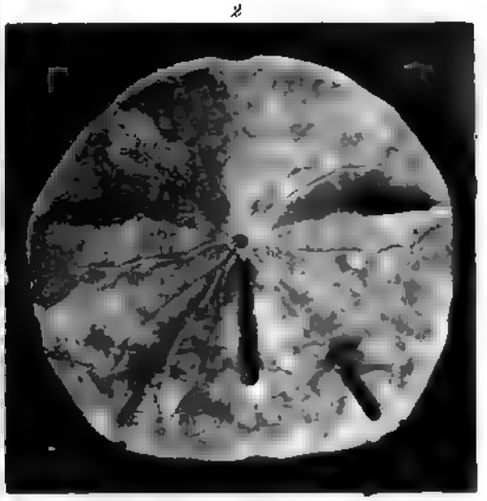


A. SORBEL, Photo.

American Photo-Relief Co., Printers, Phila.

PLATE XII[d].

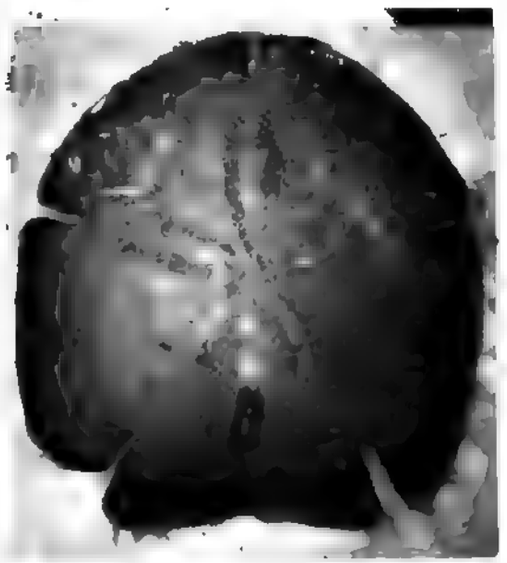
Encope emarginata, *f. 1–3.*

1. Seen from above, covered with spines, $\frac{2}{3}$ nat. size.
2. Seen from actinal side, denuded, $\frac{2}{3}$ nat. size.
3. Same as fig. 2, from abactinal side, $\frac{2}{3}$ nat. size.

Clypeaster subdepressus, *f. 4.*

4. Young specimen, nat. size, seen from above.

1



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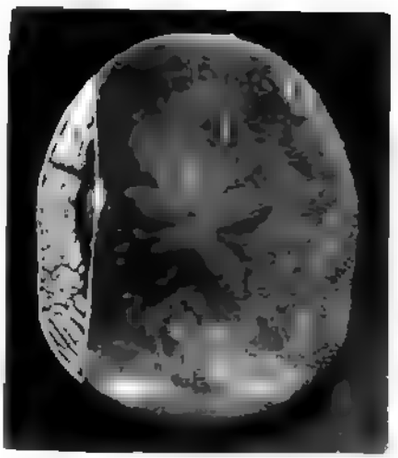

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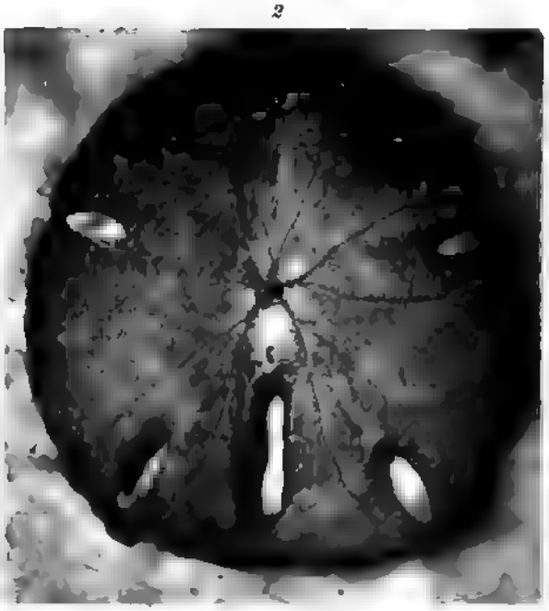

3

PLATE XIII.

Echinocyamus pusillus, *f. 1–8.*

1. Specimen seen from above, 4.74$^{mm.}$ in diam.
2. Magnified portion of test showing pores along sutures, same specimen as fig. 1.
3. Magnified portion of test, showing rosette and connection with sutural pores of same.
4. Same specimen from actinal side.
5. Anal plates of same.
6. Older specimen, measuring 7.5$^{mm.}$ in diam., showing greater development of rosette.
7. Section of specimen measuring 6.3$^{mm.}$ in diam.
8. Anal plates of fig. 6.

Echinanthus rosaceus, *f. 9.*

9. Young Echinanthus rosaceus, from above, nat. size.

Clypeaster subdepressus, *f. 10–18.*

10. Young Clyp. prostratus, 15.4$^{mm.}$ in diam. from above.
11. Section showing interior edge of specimen.
12. Magnified portion of test of fig. 10.
13. Ambulacral petal and part of test of same.
14. Median interambulacral edge of test of specimen measuring 21.7$^{mm.}$ in diam.
15. Section of edge of same, showing trace of needle-like pillars.
16. Specimen, seen from abactinal side, nat. size.
17. Different specimen, showing structure of edge of test, nat. size.
18. Same from actinal side, nat. size. The bare part of test, near the ambulacral furrows, is not quite distinctly enough marked in the figure.

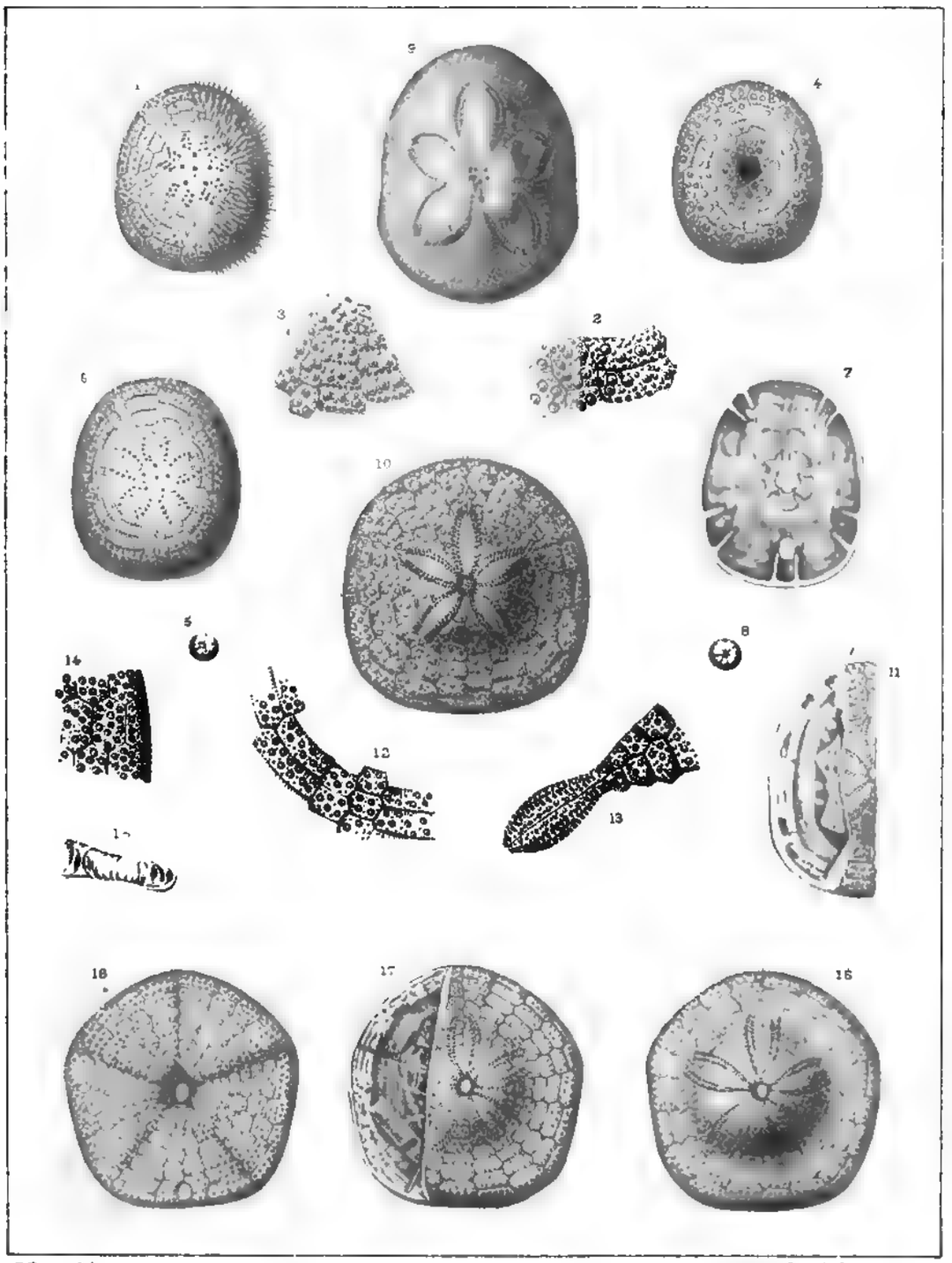

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PLATE XIV.

Echinonëus semilunaris, *f. 1–5.*

1. Seen from above, partly with spines and tentacles.
2. Part of test, with spines, tentacles, and pedicellariæ, magnified.
3. Part of test without spines.
4. Actinostome and anal system.
5. Anal system, showing arrangement of plates when spines are removed.

Echinonëus cyclostomus, *f 6–8.*

6. Anal and actinal systems, showing plates, in specimen 31.7^{mm}. in longitud. diam.
7. Part of test magnified.
8. Young tubercles in specimen, 12.7^{mm}. in longitud. diam.

Agassizia excentrica, *f. 9–12.*

9. Very young, measuring 6.2^{mm}. in diam., seen from above.
10. Same, seen from actinal side.
11. Ambulacral rosette of same specimen, more magnified.
12. Same in profile, to show fascioles.

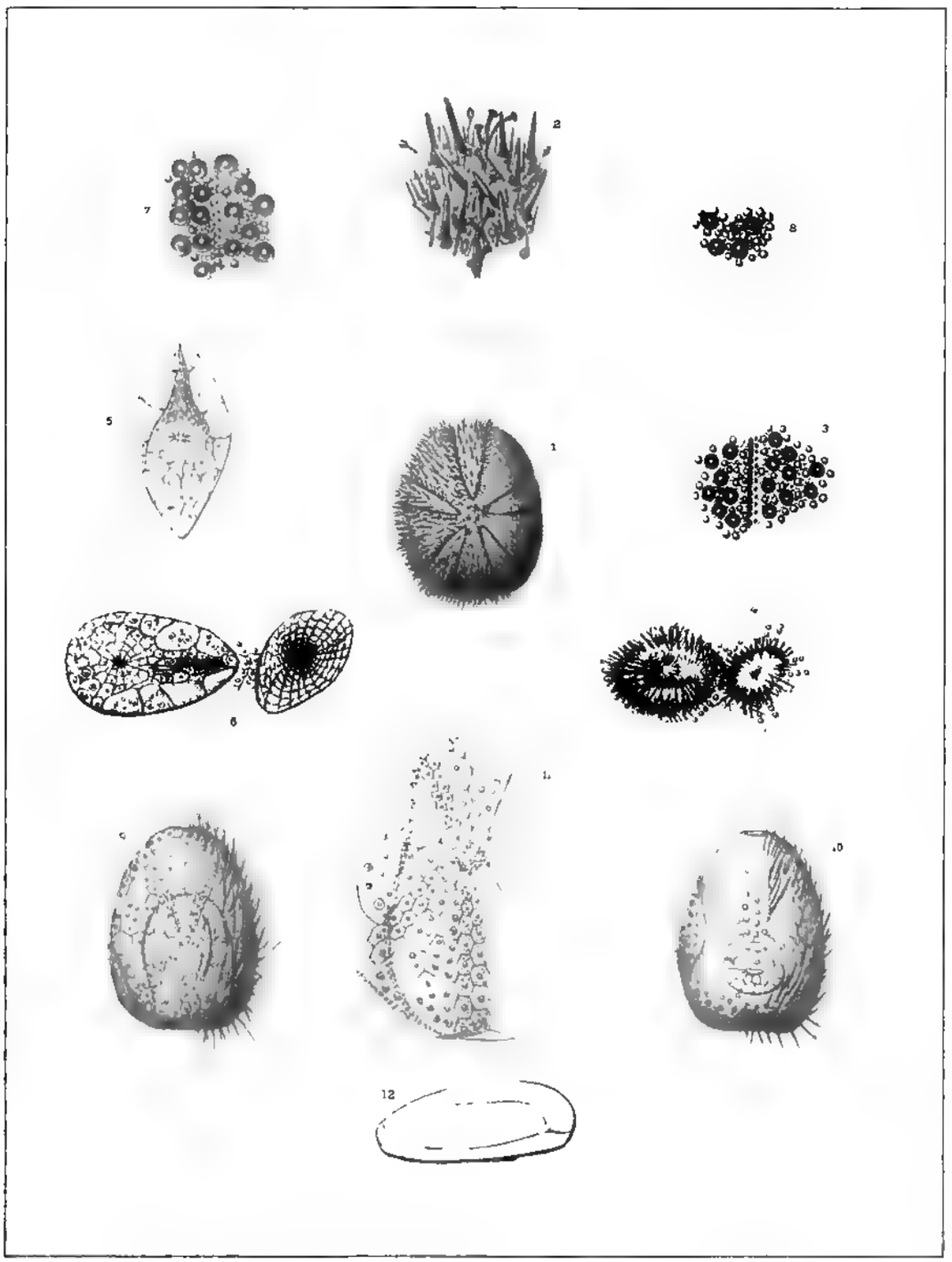

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PLATE XIV[a].

Spatangus purpureus, *f. 1.*

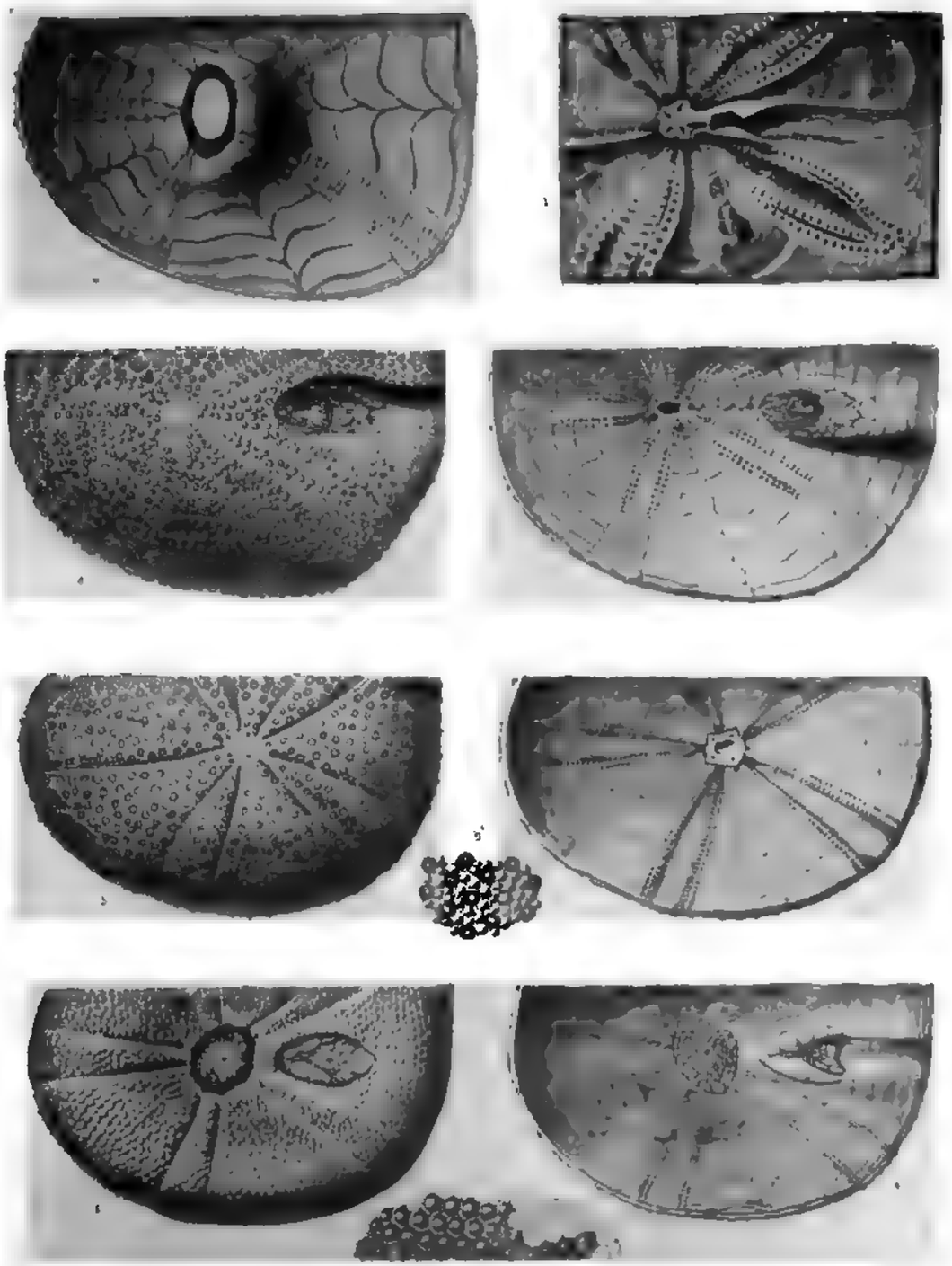
1. Abactinal system, and part of ambulacral system, from interior of test, magnified $1\frac{1}{1}$.

Echinobrissus recens, *f. 2–4.*

2. Seen from abactinal pole, denuded, magnified $\frac{2}{1}$.
3. Same, from interior of test.
4. Actinal part of test, seen from interior.

Echinonëus cyclostomus, *f. 5–10.*

5. Seen from abactinal pole, magnified $2\frac{1}{1}$.
6. Same seen from actinal side.
7. Same, abactinal part of test, seen from interior.
8. Same, actinal part of test, seen from interior.
9. Magnified cluster of tubercles of abactinal part of test.
10. Magnified cluster of tubercles of actinal part of test.



Dickmann et A Agassiz del. E Bierstadt's Albertype.

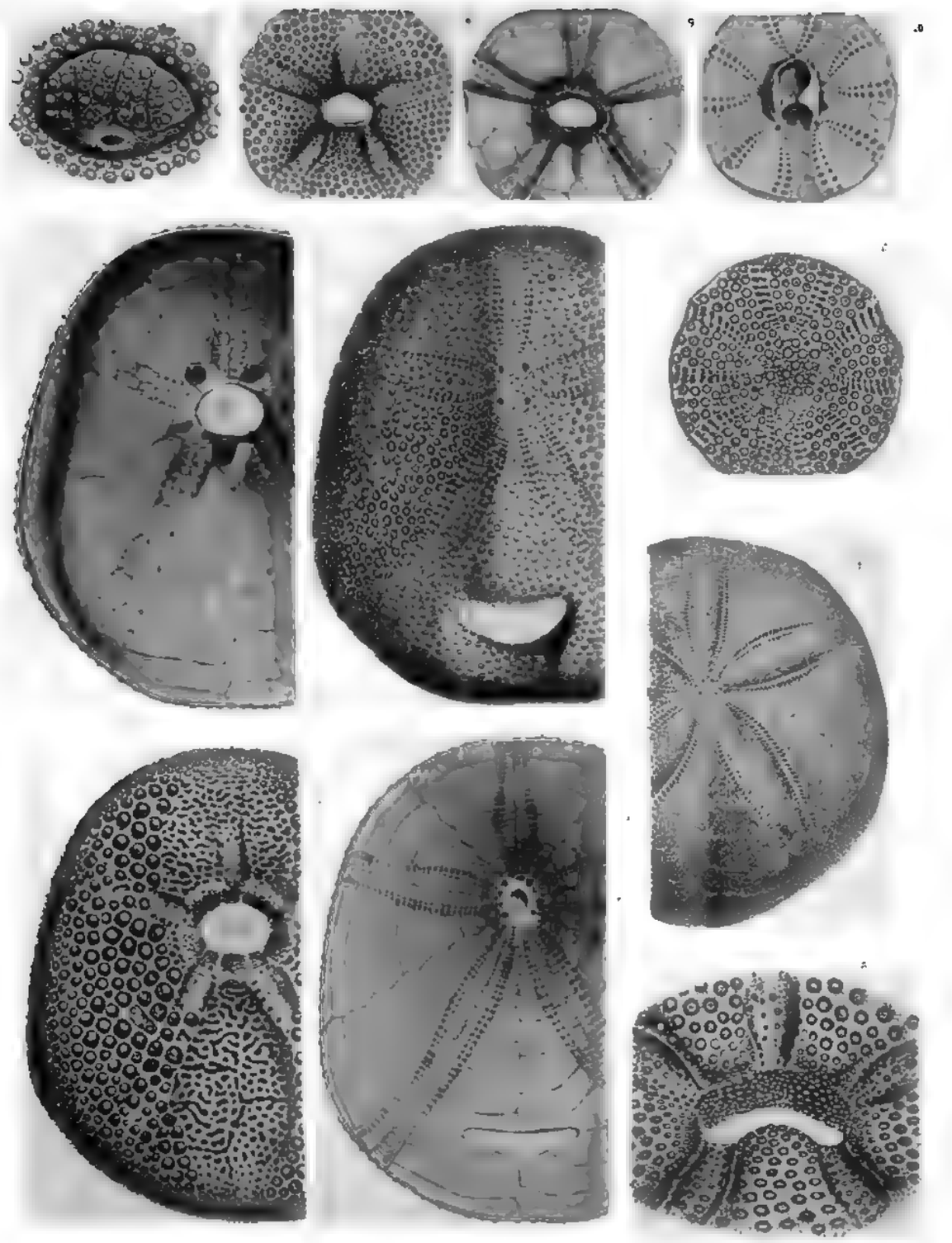
PLATE XV.

Rhynchopygus caribaearum, *1–4.*

1. Section showing actinostome and lower part of test from interior, $\frac{4}{1}$ in diam.
2. Same, test denuded, from above, $\frac{4}{1}$ in diam.
3. Same, actinal side, showing bare pitted median band, $\frac{4}{1}$ in diam.
4. Section showing abactinal part of test from the interior, $\frac{4}{1}$ in diam.

Echinolampas Hellei, *5–11.*

5. Seen from above, nat. size.
6. Actinostome of same, enlarged, showing bourrelets and phyllodes, slightly inclined.
7. Anal system of same, enlarged.
8. Actinostome of same, somewhat less magnified than fig. 6.
9. Actinostome, seen from interior of test, enlarged.
10. Abactinal system, seen from interior of test, enlarged.
11. Abactinal system, seen from above, enlarged.



Lith. Bernard et A. Agassiz fils.

Imprimerie de Lemercier

PLATE XVI.

Echinolampas depressa.

1. Young specimen, seen from above, 4.0$^{mm.}$ in diam.
2. Same, from the actinal side.
3. Same, seen in profile.
4. Magnified part of test of same.
5. Anal plates of same.
6. Part of ambulacral rosette of specimen measuring 7.9$^{mm.}$ in diam., showing commencement of petaloid ambulacra.
7. Ambulacral rosette of specimen measuring 12.7$^{mm.}$ in diam., somewhat more petaloid than previous figure.
8. Young specimen, seen from above, measuring 12.7$^{mm.}$ in diam.
9. Same, from actinal side.
10. Same, seen in profile.
11. Magnified part of test of same.
12. Still more magnified part of test of same.
13. Part of test of same, with spines and suckers fully expanded.
14. Anal plates of same.
15. Pedicellaria of same.
16. Spine of same from the interambulacral area.
17. Young Echinolampas depressa, nat. size, from above.
18. Same from actinal side.
19. Profile of same.
20. Magnified actinostome, showing first trace of bourrelets.
21. Magnified part of ambulacral rosette of same.
22. Magnified part of petaloid portion of poriferous zone.

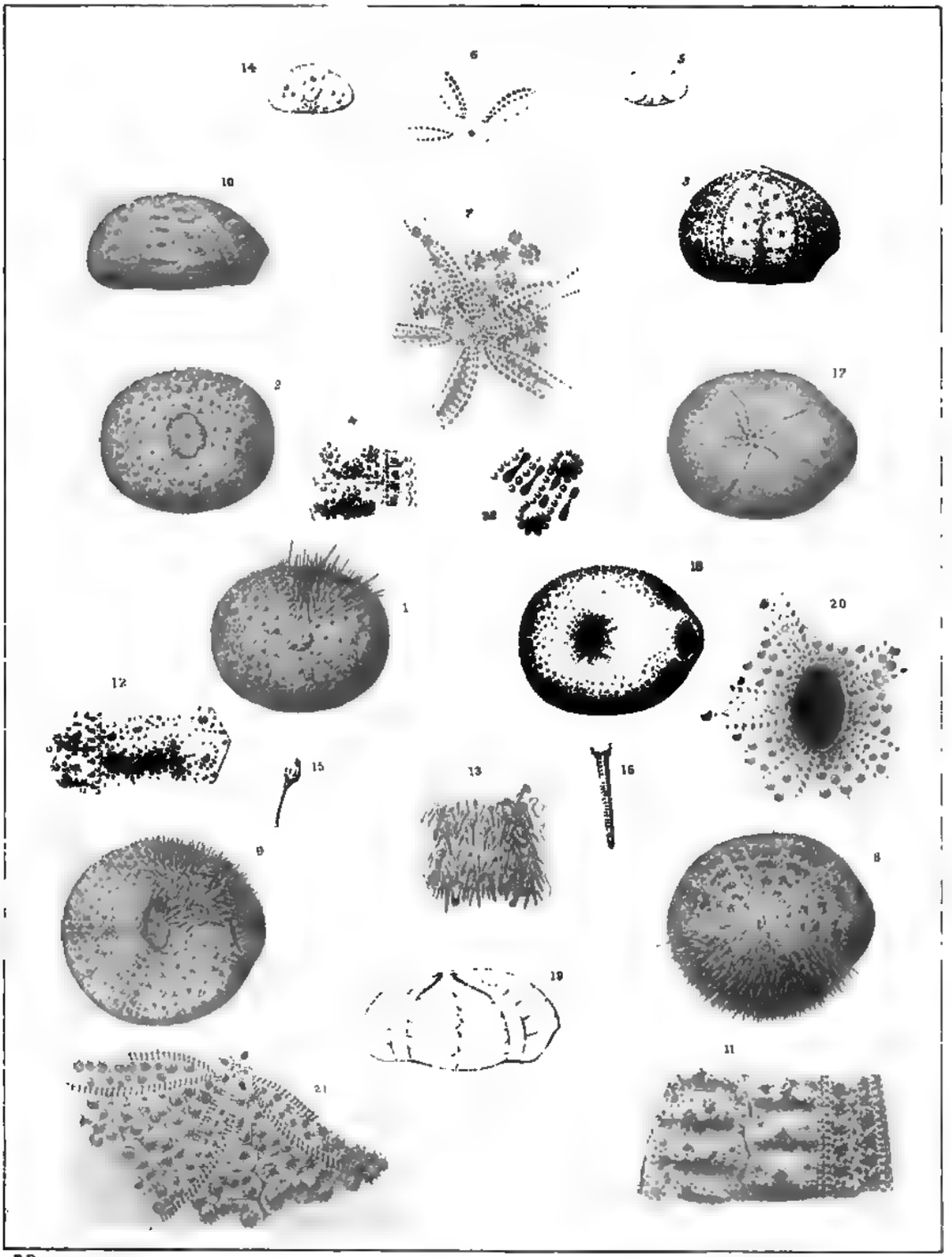


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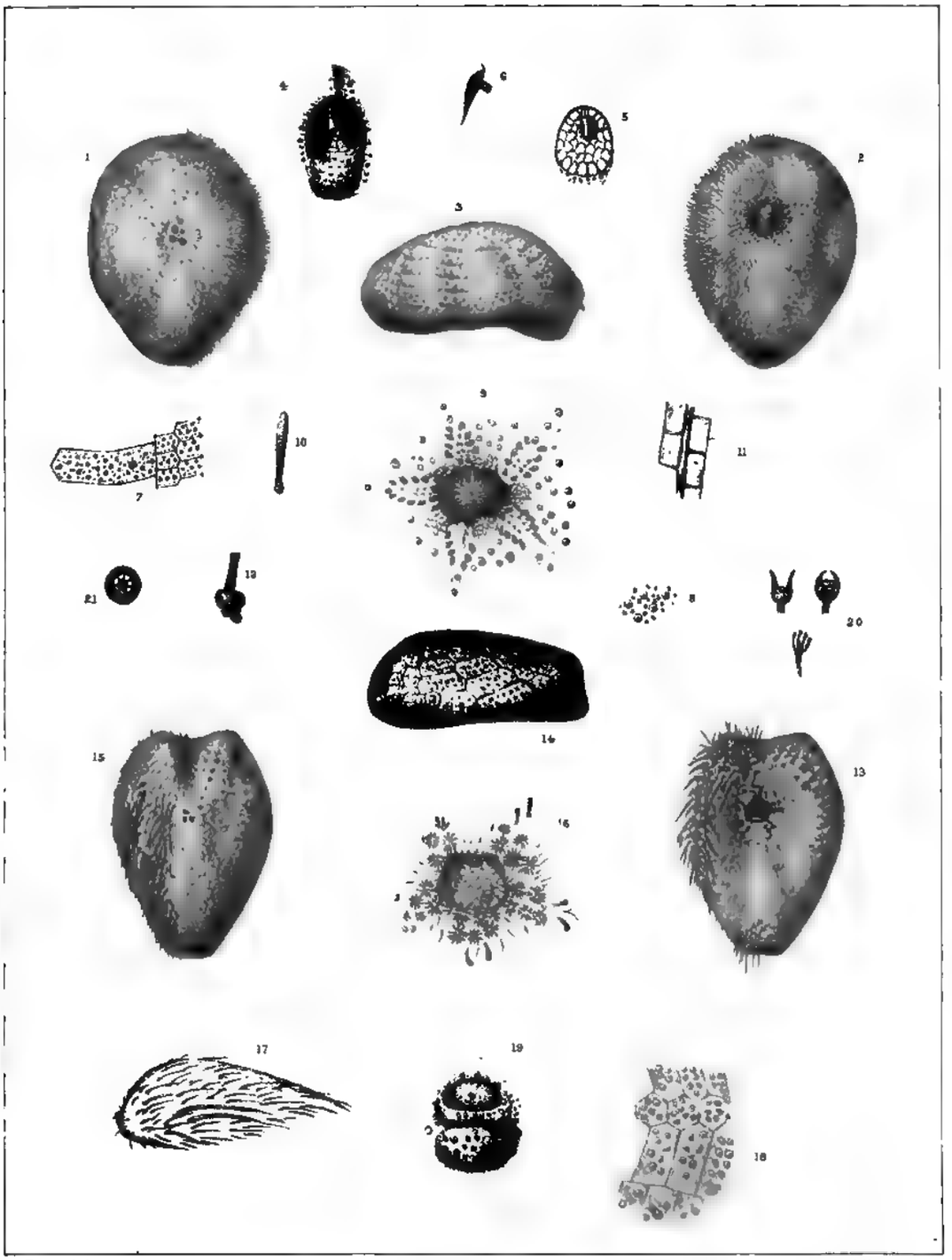
PLATE XVII.

Neolampas rostellata, *f. 1 – 12.*

1. Specimen measuring 14.7$^{mm.}$ in long. diam., seen from abactinal side.
2. Specimen measuring 14.7$^{mm.}$ in long. diam, seen from actinal side.
3. Specimen measuring 14.7$^{mm.}$ in long. diam., seen in profile.
4. Showing the anal system and tube, further magnified.
5. Showing plates composing anal system.
6. Part of Fig. 4 in profile.
7. Part of test to show tubercles.
8. Part of test more enlarged.
9. Enlarged view of actinostome.
10. Spine.
11. Part of ambulacral tube.
12. Ovary, dry.

Homolampas fragilis, *f. 13 – 21.*

13. From below, measuring 9.3$^{mm.}$ in diam.
14. In profile, measuring 9.3$^{mm.}$ in diam.
15. From above, measuring 9.3$^{mm.}$ in diam.
16. Magnified actinostome.
17. Fragment of specimen, measuring 15.5$^{mm.}$ in diam, showing Lovenia-like spines.
18. Part of test magnified.
19. Anal system and subanal fasciole.
20. Young gills adjoining actinostome.
21. Perforated crenulated tubercle, from anterior edge of test, magnified.



P. Roetter lithog. Alex. Agassiz del. Print by H.W. Longfellow

PLATE XVIII.

Pourtalesia miranda.

1. Seen in profile, magnified 3.5 in diam.
2. Same seen from actinal side.
3. Same seen from abactinal side.
4. Same seen endways from the anterior extremity.
5. Posterior extremity, seen in profile, somewhat more magnified than preceding fig.
6. Posterior extremity, seen from the abactinal side.
7. Posterior extremity, seen obliquely from above to show anal opening.
8. Anterior extremity seen obliquely to show actinostome and odd anterior ambulacrum.
9. Magnified view of abactinal system, with expanded tentacles.
10. One of the long slender spines greatly magnified.
11. Imperforate crenulated tubercle, with broad scrobicular circle, carrying large spines.
12. Base of large spine seen in profile with attachment.
13. Base of large spine, with tubercle, showing mode of attachment to scrobicular circle.
14. One of the small flattened short spines of test, greatly magnified.
15. Extremity of one of the smaller fan-shaped spines like fig. 10, magnified.
16. Extremity of one of the large tridactyle pedicellariæ, fully expanded, in profile.
17. Same from above.
18. Same contracted, from above.
19. A couple of the large tentacles of the odd anterior ambulacrum, magnified.

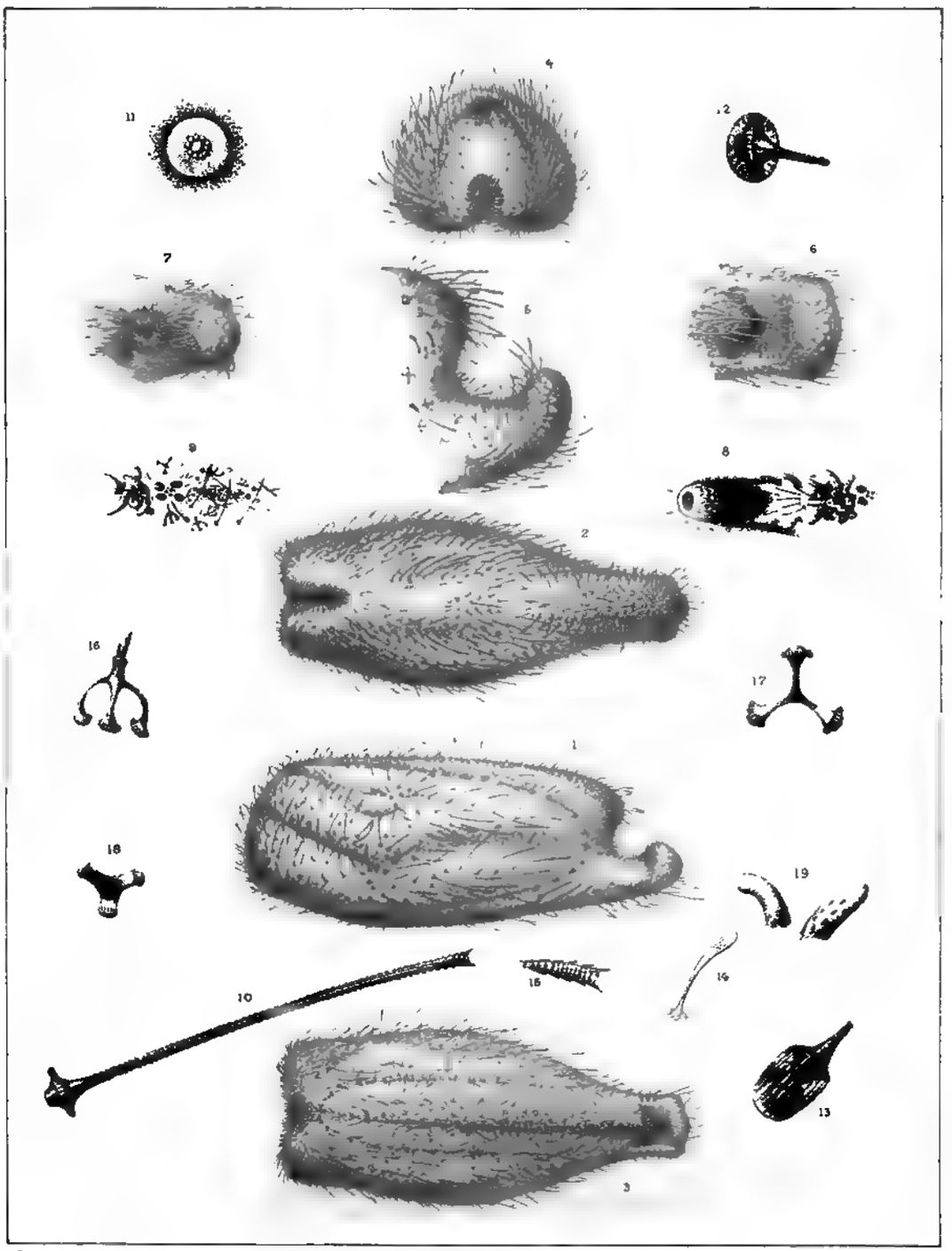


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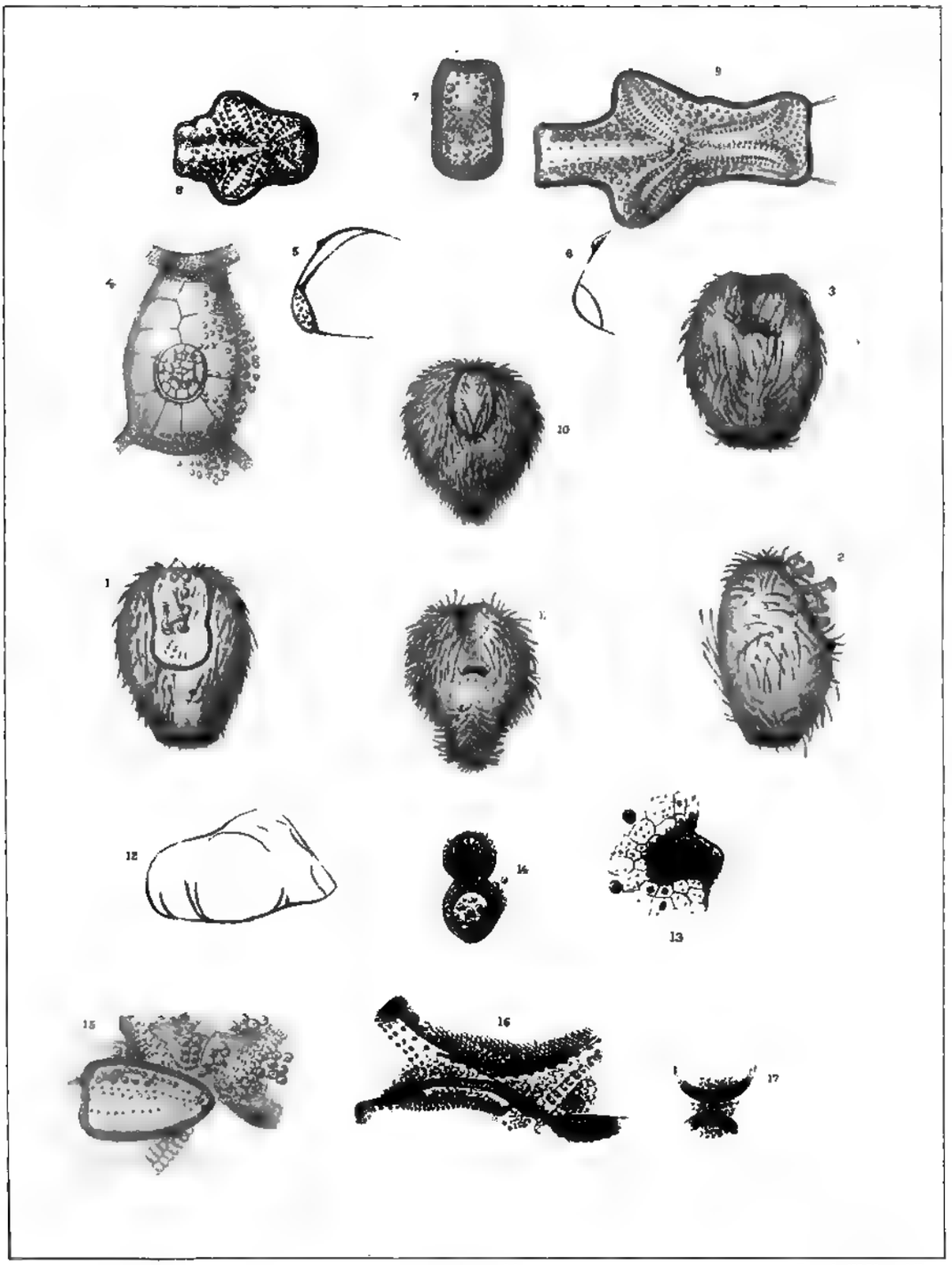
PLATE XIX.

Brissopsis lyrifera, *f. 1 – 9.*

1. Specimen, measuring 5.6$^{mm.}$ in diam., from abactinal side.
2. Specimen, measuring 5.6$^{mm.}$ in diam., in profile.
3. Specimen, measuring 5.6$^{mm.}$ in diam., from actinal side.
4. Older specimen, showing branch leading from subanal fasciole to peripetalous fasciole.
5. Posterior extremity, profile of same.
6. Profile of specimen measuring 22.5$^{mm.}$
7. Peripetalous fasciole of young specimen, measuring about 3.6$^{mm.}$ in long. diam.; 4 : 3 pairs of pores in anterior, 2 : 3 in posterior lateral ambulacra.
8. Peripetalous fasciole of specimen intermediate between figs. 7 and 9.
9. Peripetalous fasciole of specimen measuring 27.9$^{mm.}$ in long. diam., showing partial confluence of lateral ambulacra.

Echinocardium cordatum, *f. 10 – 17.*

10. Seen from abactinal side, measuring 7.9$^{mm.}$ in long. diam.
11. Same from actinal side.
12. Outline in profile of same.
13. Actinostome of same magnified.
14. Anal and subanal fascioles of same.
15. Ambulacral rosette of same.
16. Ambulacral rosette of older (fully grown) specimen, showing confluent lateral ambulacra.
17. Disconnected anal and subanal fascioles of specimen of fig. 16.



E Koetter lithog. Alex Agassiz del Print, by H W Longfellow

PLATE XX.

Echinocardium pennatifidum, *f. 1, 2.*

1. From above.
2. In profile.

Echinocardium flavescens, *f. 3–4.*

3. Seen from above.
4. Seen from actinal side.

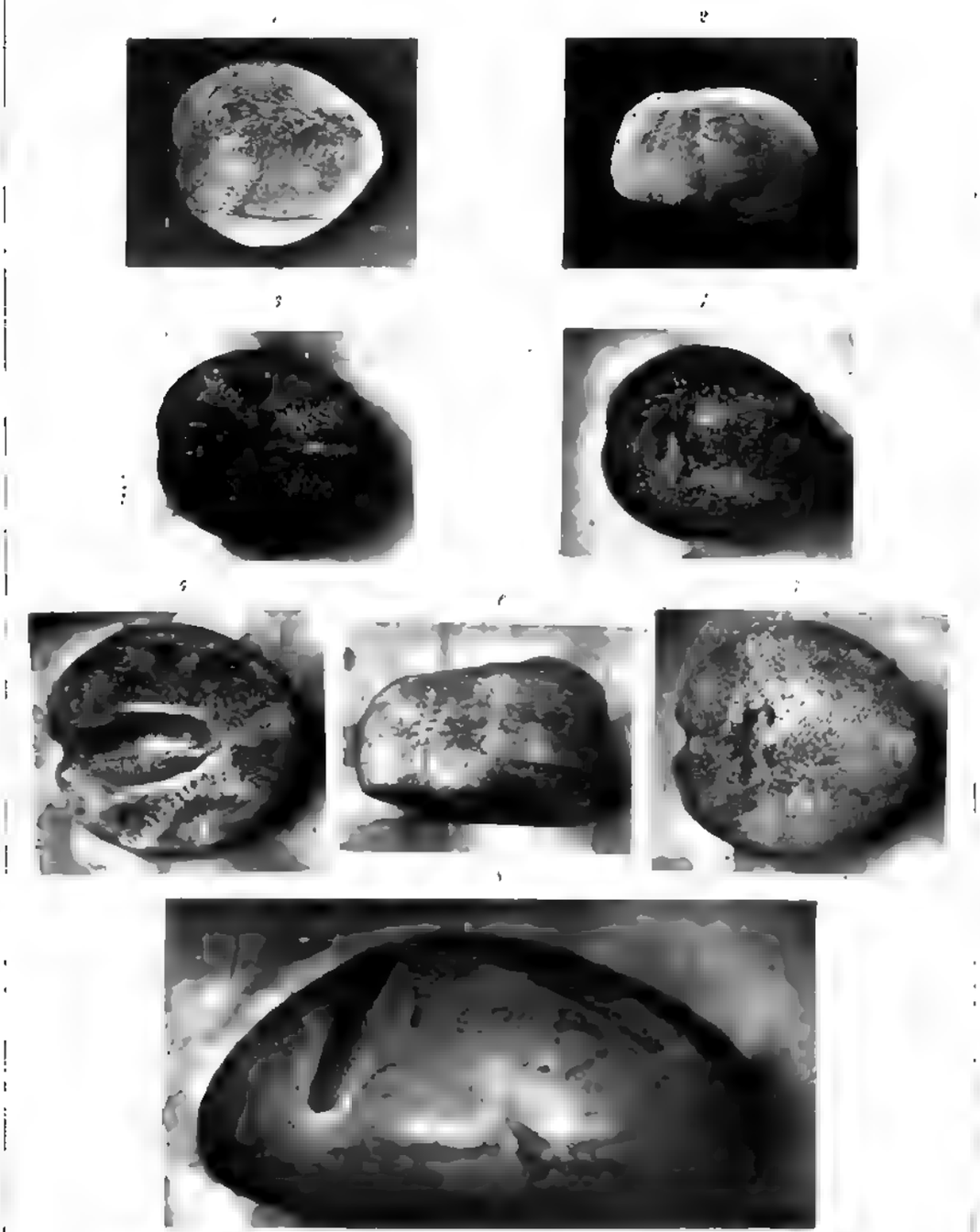
Echinocardium cordatum, *f. 5–7.*

5. Seen from above.
6. Profile of same.
7. Actinal view of same.

Meoma ventricosa, *f. 8.*

8. Seen in profile, $\frac{3}{4}$ nat. size.

(*All figs. natural size, except fig.* 8.)



A. SONREL, Photo. American Photo-Relief Co., Printers, Photo.

PLATE XXI.

Brissopsis lyrifera, *f. 1, 2.*

1. Seen from actinal side, nat. size (from Norway).
2. Seen from above, nat. size.

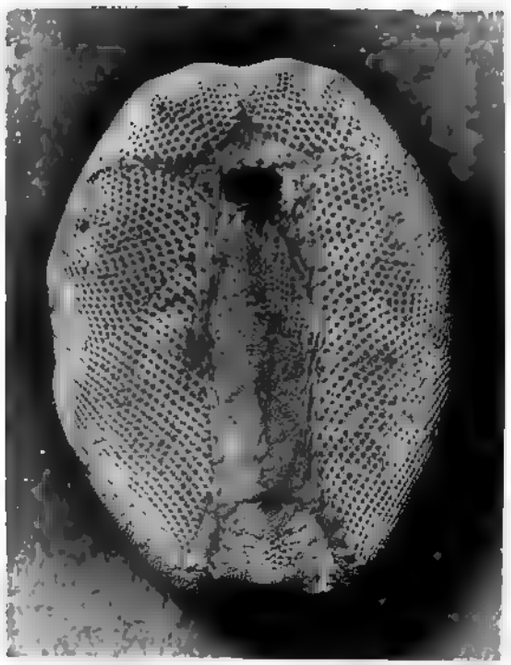
Schizaster fragilis, *f. 3.*

3. Seen from above, nat. size (from Norway).

Metalia pectoralis, *f. 4, 5.*

4. Seen from actinal side, $\frac{2}{3}$ nat. size.
5. Seen from abactinal pole, $\frac{2}{3}$ nat. size.

4



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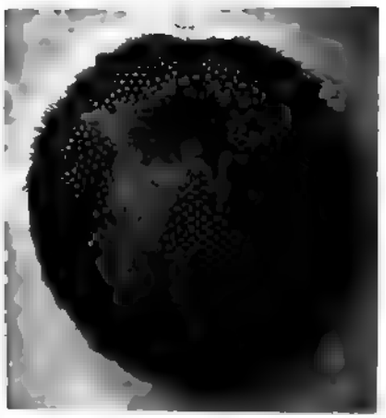

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A. SCHEEL, Photo.

American Photo-Relief Co., Printers, Phila.

PLATE XXII.

Brissus unicolor, *f. 1, 2.*

1. Seen from abactinal pole, nat. size.
2. Seen from actinal side, nat. size.

Meoma ventricosa, *f. 3, 4.*

3. Seen from abactinal pole partly denuded, $\frac{3}{4}$ nat. size.
4. Seen from actinal side, $\frac{3}{4}$ nat. size.

2

1

4

3

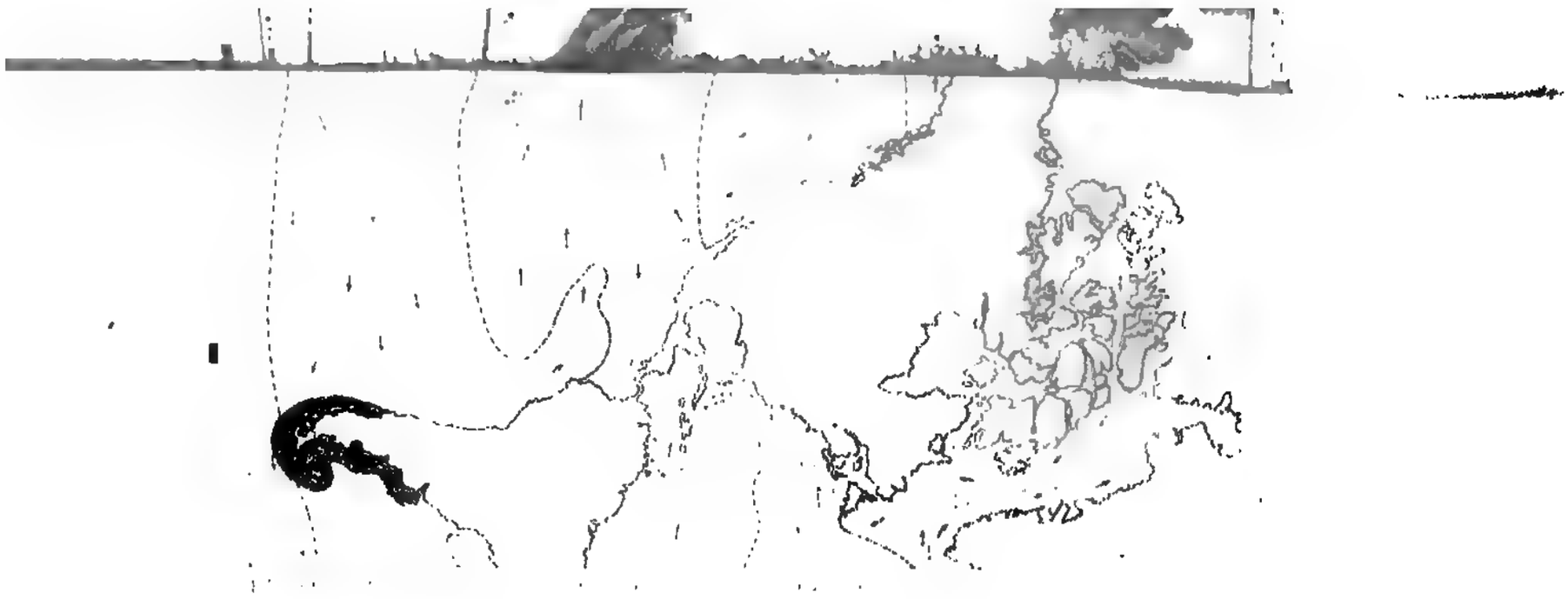
A. SONREL, Photo. American Photo-Relief Co., Printers, Phila.

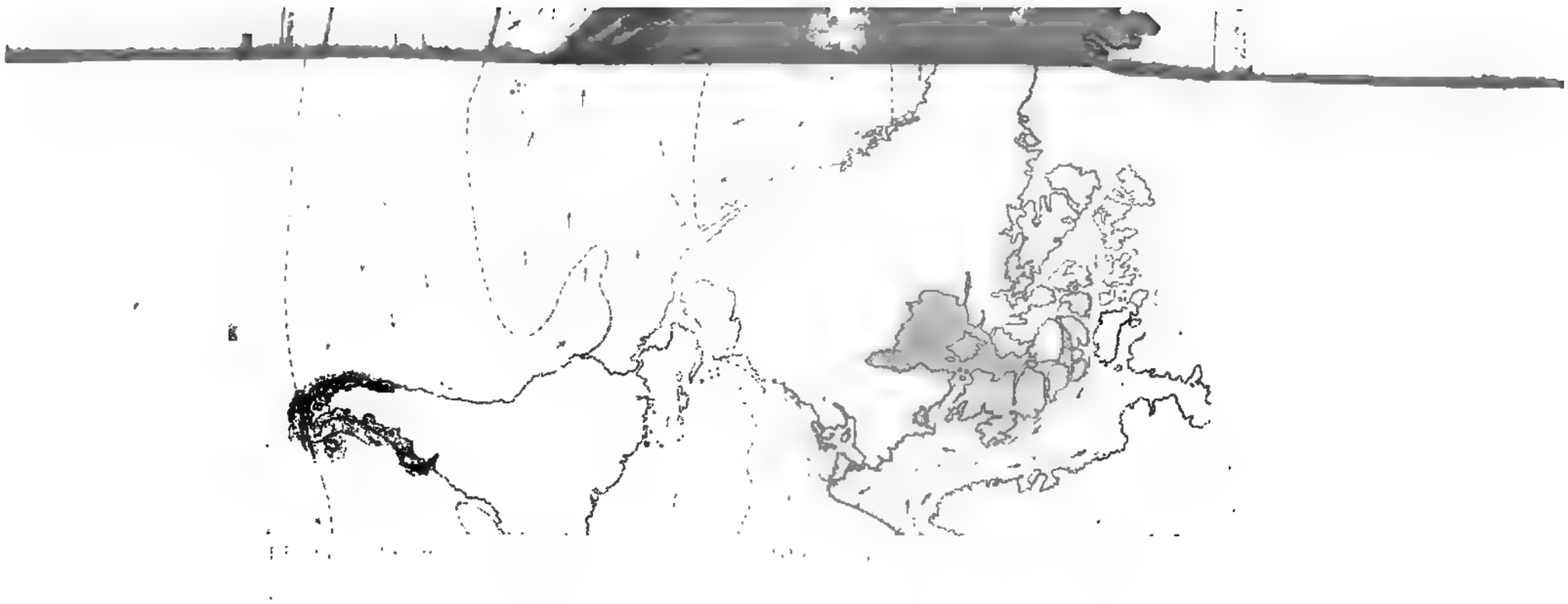
PLATE XXIII.

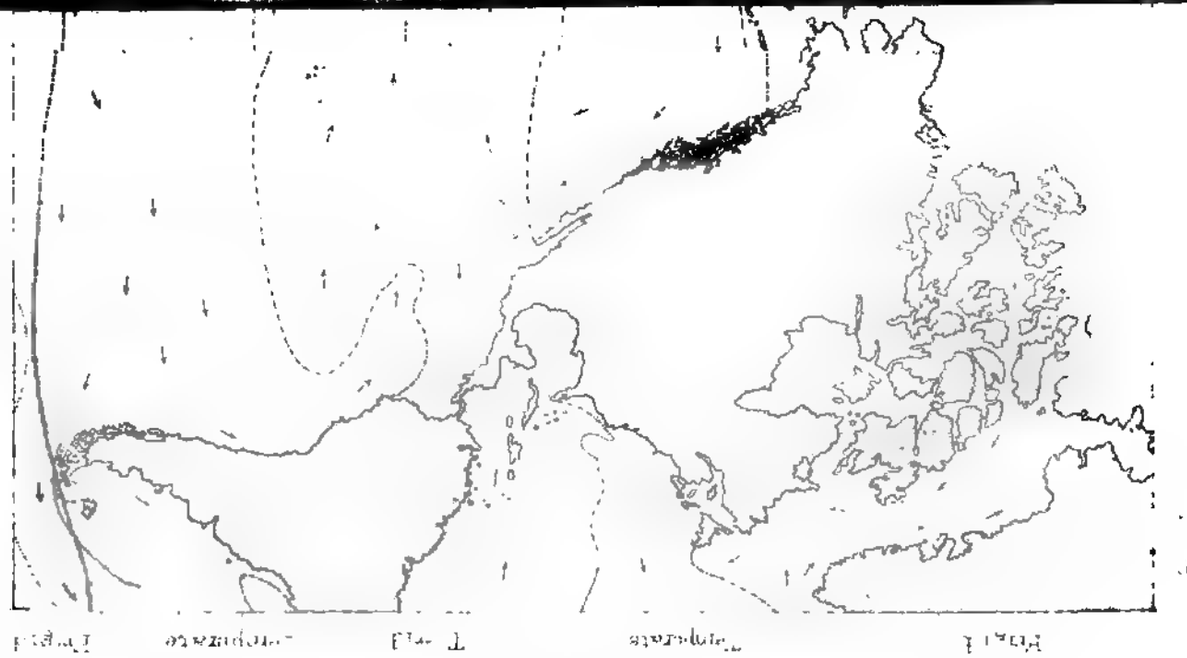
Moira atropos.

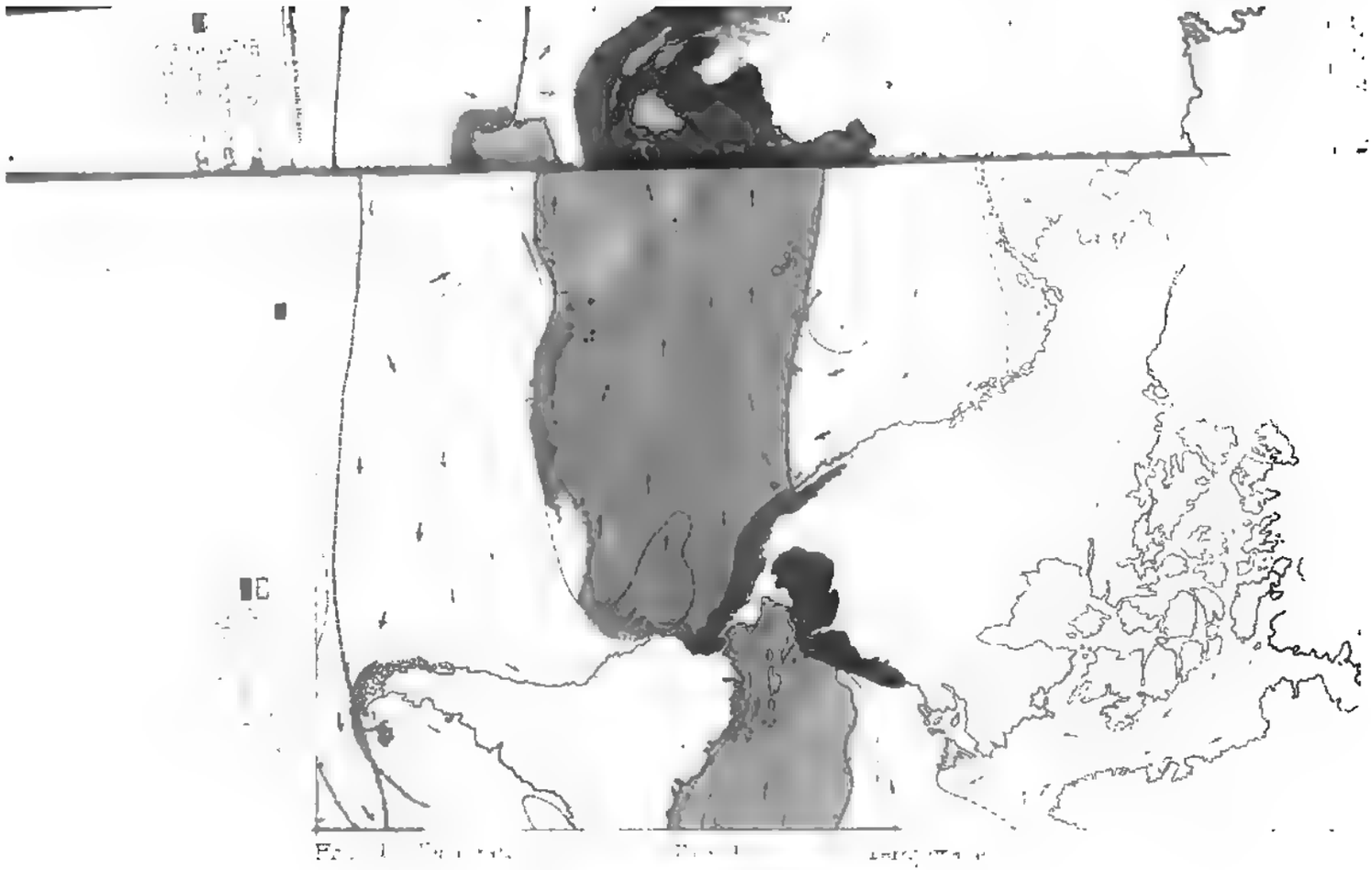
1. Horizontal section, showing arrangement of plates round actinostome.
2. Longitudinal section.
3. Horizontal section, showing the petaloid ambulacra as seen from the interior of test.
4. Seen from actinal pole.
5. Seen from abactinal pole.
6. Profile.

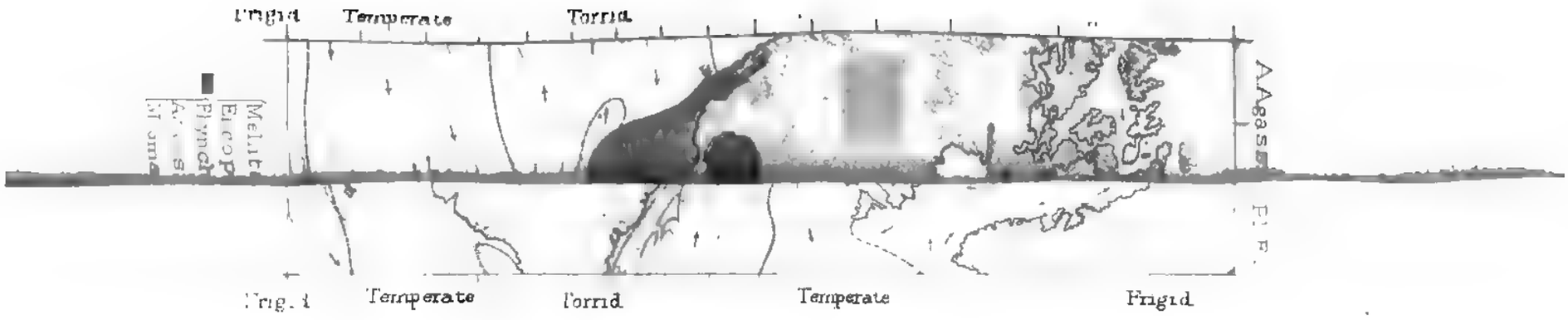
(*All figs. nat. size.*)







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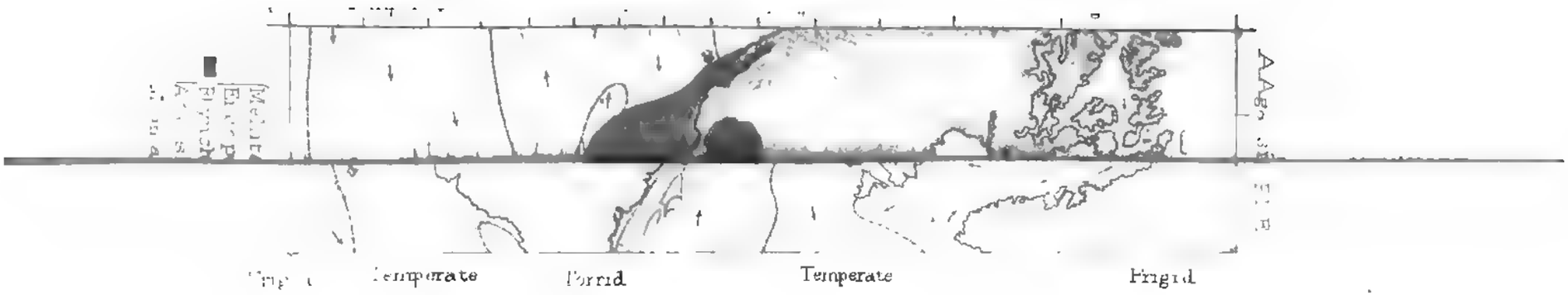
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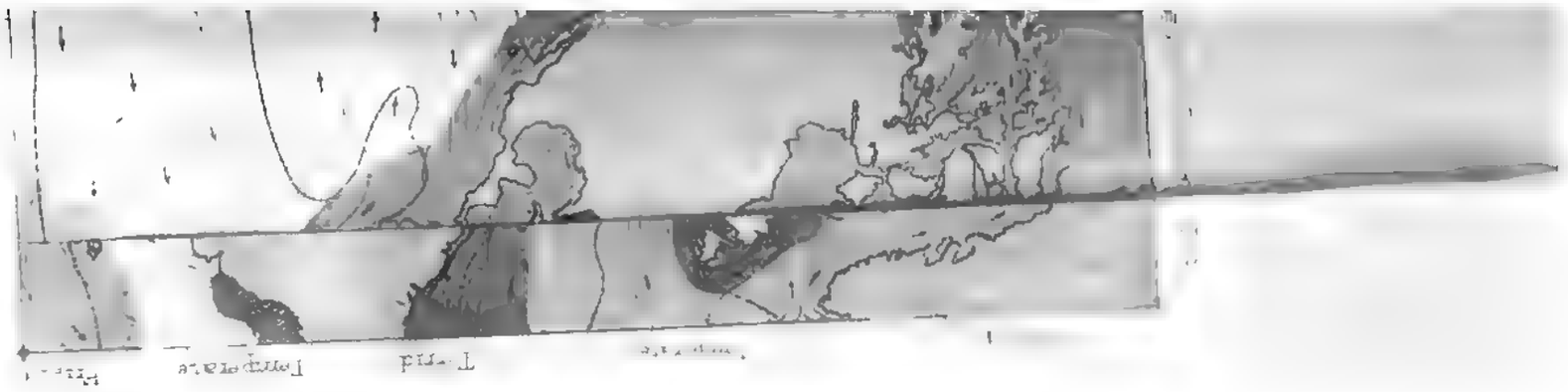
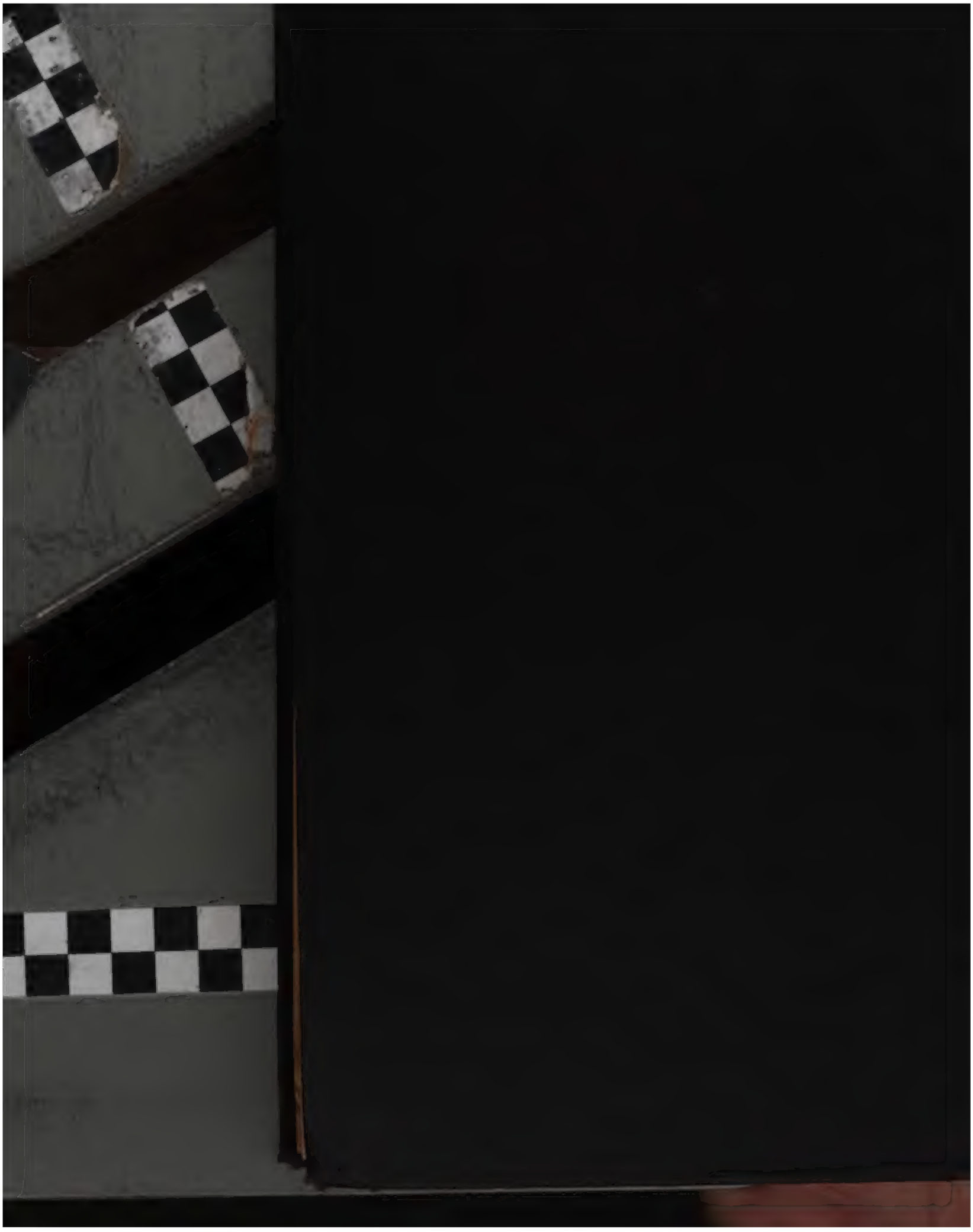
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